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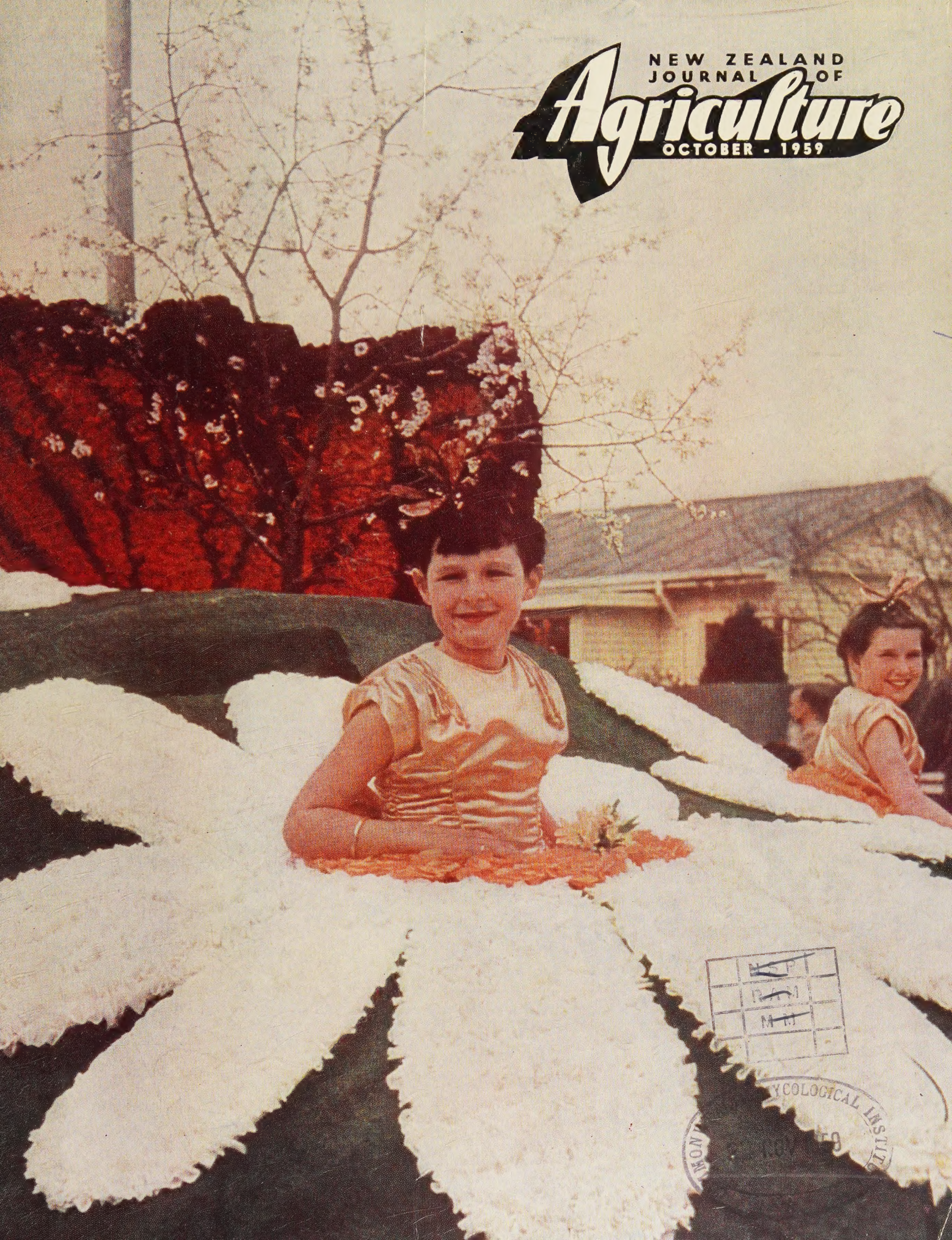

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[B. R. Watson

Living "flowers" on a Hastings blossom festival float are featured on our cover this month. A procession of flower-decked vehicles is the show piece of the annual Hawke's Bay blossom festival held in the heart of the principal stone and pip fruit growing area of the North Island. The festival is timed to coincide with the main blossoming period of the district's 3,000 acres of fruit trees.

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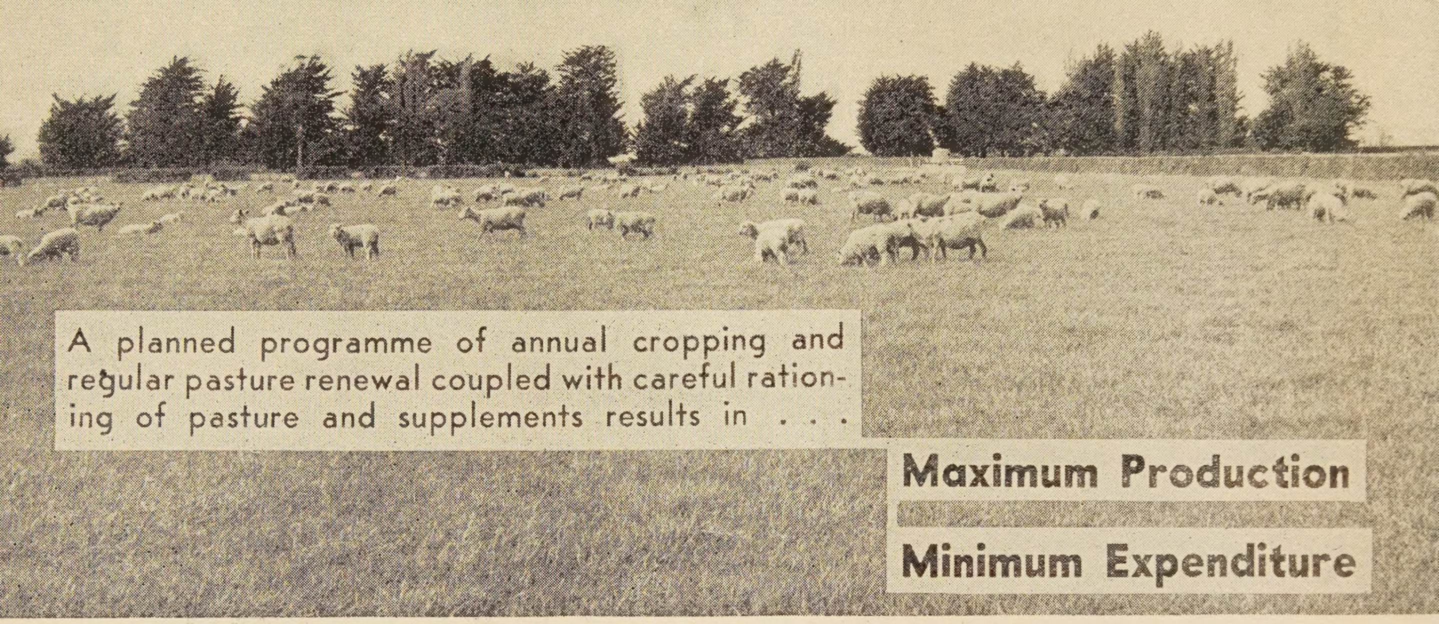
Better Feeding of Ewe Flocks on Mixed Farms in Canterbury



A planned programme of annual cropping and regular pasture renewal coupled with careful rationing of pasture and supplements results in . . .

Maximum Production

Minimum Expenditure

MOST of New Zealand's cash cropping is done on mixed farms in Canterbury, yet sheep provide the largest share of income, and grass, as elsewhere in New Zealand, is the principal "crop". This article by E. G. SMITH, Instructor in Agriculture, Department of Agriculture, Rangiora, explains how better use can be made of grass growth on these farms to improve the feeding of ewe flocks and how this management is fitted in with the growing of cash and fodder crops.

THE usual rate of stocking on Canterbury mixed farms results in two main periods when grass growth is beyond stock requirements. Pastures give more than half their annual production during late spring and early summer and there is also surplus growth in normal autumns. Shortages are experienced in May, June, July, and August, when pasture plants are more or less dormant, and again in late summer, when the weather is usually too dry to promote suitable growth for lamb fattening.

Pasture

In spite of these seasonal variations in pasture production, grass is the most important crop. A sward well balanced in good strains of grasses and clovers is undoubtedly the cheapest and best of all stock foods and with high stock-carrying capacity soil fertility is rapidly increased.

There is still room for considerable improvement of pastures throughout Canterbury, though they are vastly superior to those of 20 years ago. The widespread use of improved strains of pasture plants and the increased use of lucerne, coupled with adequate top-dressing with lime and phosphates and sometimes trace minerals, have lifted the production and extended the growing season of Canterbury grasslands.

If the total production of these improved swards was used to the best possible advantage, many farms could support the numbers of stock they now carry without the aid of the annual forage crops they grow today. The growing of annual supplements is profitable only where all pasture growth surplus to the immediate needs of stock and of small seed crops is stored for later feeding in the form of hay, silage, or saved grass.

In the past some of the spring and early summer surplus has been controlled by closing some paddocks for small seed production and others for hay and silage. Some of the autumn surplus has been nursed for winter and early spring use, but a great deal of valuable feed has been wasted because of poor pasture control and periodical overfeeding of breeding ewes.

With a fall in prices for wool, meat, and small seeds the area in annual cash crops is increasing, so if stock numbers are to be maintained or increased, ewes will be concentrated on a smaller area with consequent difficulties at the two periods when pasture growth is insufficient for stock needs.

Crops of small seeds will be harvested only from paddocks which give promise of high yields and all other surplus pasture growth should be conserved as hay, silage, or autumn-saved grass.

Silage

There is still a common belief that silage making is an extremely arduous undertaking, but under average climatic conditions the making of good silage may be more simple and less laborious than the making of inferior hay.

Silage making has some distinct advantages. The closing of some paddocks in early spring simplifies pasture management, for it facilitates controlled grazing by a heavy concentration of stock on other parts of the farm. If an early cut of silage is taken while the grass is still young and leafy, the crop is off the paddock before dry weather sets in and the aftermath gives ideal fodder for lambs at weaning. Silage is stored in pits or clamps and can be held for a number of years without appreciable loss in quality. It provides a nutritious fodder during periods of shortage, whether they occur in winter or summer.

It is not suggested that silage should replace hay, but rather that it should be made early in the season, when the weather is unfavourable for hay making. It should also be made in wet seasons, when thousands of acres of grassland are allowed to run to rank growth, with the result that pastures deteriorate and substantial quantities of valuable feed are wasted. More attention to silage making, particularly in wet seasons, would not only add to the store of stock food for use in less favourable periods, but would provide a profitable method of pasture control with resultant improvement in the autumn productivity of pastures and reduction in the area cultivated for annual forage crops.

Autumn Management

The importance of careful pasture management in autumn cannot be over-emphasised and every effort should be made to close a substantial area of grass-dominant pasture for late winter and early spring feed. The topdressing programme should be completed by mid April. All pastures should be sampled beforehand for grass grub population and DDT superphosphate used where necessary.

In swards where ryegrass is weak, overdrilling with short-rotation ryegrass followed by winter spelling will result in a valuable bulk of nutritious fodder for early lambing ewes.

Supplementary Feeding

Pastures in Canterbury are practically dormant for about 100 days in winter and their production is comparatively low during dry summers. If the farm is to be stocked to capacity, supplementary feeding is essential during these pinch periods. Though hay, silage, and autumn-saved grass will go a long way toward bridging these gaps, there are few mixed farms in Canterbury where maximum stock numbers can be maintained on grass products alone, and the growing of annual forage crops is therefore necessary.

The economics of growing forage crops are often questioned, but costs must be spread over all crops in the rotation of grass back to grass and not considered in relation only to the forage crop. Supplementary feed crops fit into a rotation by paving the way for cereal growing and pasture renewal, and systematic pasture renewal is essential to maximum returns.

With the exception of special-purpose pastures such as lucerne-grass mixtures, pastures on light to medium soils are usually deteriorating after five or six years; even on the heavier land it is difficult to maintain them at their best after seven or eight years. It is important, therefore, to plan a suitable crop rotation for the renewal of these pastures.

Crops and acreages sown for winter forage will vary from district to district and from farm to farm. Swedes find favour in the high-rainfall areas, while turnips, chou moellier, and green feed cereals are grown in other districts. Though white-fleshed turnips, chou moellier, kale, and more recently Borre lupins are grown to supplement grass and lucerne for lamb fattening, rape is still by far the most popular crop for this purpose.

Turnips

In spite of the ravages of cauliflower mosaic and such pests as diamond-back moth, white butterfly, and aphids, turnips are widely used for winter feed because of their high yield and the fact that they thrive on the lighter soils where swedes would fail. January and February sowings generally give best results.

Though the advantages of a winter fallow are fully appreciated, there is much to be said for the practice of feeding hay and silage over winter on the paddock selected for turnips, thus raising soil fertility by the concentration of stock before ploughing as soon as spring growth begins. This permits more lenient grazing of other pastures, which consequently come away more rapidly in spring.

Chou Moellier and Kale

The area sown in chou moellier and kale either alone or with turnips has increased in recent years. Both have a dry-matter content greater than that of turnips, are resistant to club root and mosaic, and lose little in quality over winter. Chou moellier and kale are especially valuable when other crops are covered by snow.

Green Feed

Provision of green feed for ewes in late winter and early spring is important and the choice lies between young

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Silage making has the twofold advantage of adding to the store of stock food for use in periods when succulent feed is short and of being a profitable method of preventing the development of rank growth.

grass, temporary pasture, autumn-saved pasture, and the cereals, oats, barley, ryecorn, and wheat or combinations of these.

The most valuable of these is undoubtedly a young pasture well balanced in short-rotation or Italian ryegrass and clovers. The production of these pastures sown on well prepared land after a summer fallow is high and the type of feed is ideal for ewes in late pregnancy. On farms where short-rotation and Italian ryegrass are not favoured because of fear of contamination of perennial ryegrass seed crops, a young stand of perennial ryegrass with suitable clovers will fill a very useful place.

However, if green feed is to be sown late in the season or when soil or moisture conditions are unfavourable, any of these pasture mixtures may give disappointing results, whereas a green feed cereal will thrive.

Algerian oats are the most common choice, though Duns are hardier and do well over a wide range of soil types. Both varieties make excellent recovery after grazing and can be fed again and again. Of the white oats Russets makes considerably better recovery than varieties such as Abundance.

Cape barley is widely grown for green feed, though Black Skinless establishes more quickly and is ready for grazing before any of the other cereals. Wong barley has given satisfactory results when grown under ideal conditions, but otherwise its winter production is low. Its most important feature is its power of recovery after grazing.

Ryecorn is the most hardy of the green feed cereals, but unless soil fertility is reasonably high its early winter production is low. There are numerous strains of ryecorn with varying performances but the certified strain (C.R.D.) will generally give superior results.

Experimental data are not yet available, but it appears that Arawa wheat is capable of filling an important place as a green feed, especially for use in July, August, and September.

Any of the winter forage crops may be sown with short-rotation ryegrass or Italian ryegrass. This gives better fodder and a longer productive season.

White-fleshed turnips, kale, chou moellier, and sweet lupins, with or without grass, are sometimes used to supplement pasture and lucerne for lamb fattening, but rape is the most popular of the fattening crops.

Rotation

The place of forage crops in the rotation will vary with conditions. There is little doubt that the wheat acreage will increase again next season, but stock numbers should also show a gradual increase. This will demand full utilisation of all grass growth and a larger area in supplementary feed crops. Winter-sown wheat will sometimes provide an early bite for ewes in spring. Where soil fertility is high and in seasons when

---

Report of Irrigation Committee 1959

The report of the Parliamentary Select Committee on Irrigation which was recently laid before the House of Representatives will be of considerable interest to farmers in the low-rainfall areas of Canterbury and Otago.

It draws attention to the slow rate of development of irrigable land by private owners in Canterbury. In an assessment of the contribution which irrigation can make toward increasing primary production and closer settlement the report points out that irrigation of our dry soils will enable farming on them to become more diversified.

Of the recommendations made by the Committee possibly the most significant is the proposal that if **60 per cent of the land holders** in a proposed irrigation area vote in favour of a scheme, they can bind the remainder of the farmers in the area to an irrigation charge being registered against their land titles. This irrigation charge provides for payment of interest at ruling rates on one quarter of the estimated cost of the scheme, plus operating and maintenance costs and depreciation and renewal charges.

At present the vote of **those holding 75 per cent of the area** decides whether a scheme is to proceed. The proposed amendment would give each land holder one vote regardless of the area of his farm.

Other recommendations include:

- A vigorous land policy should be expanded by Government purchase, development, and resettlement of land on irrigation areas and also in areas suitable for irrigation.
- The present demonstration and education programme aimed at proving the optimum water requirements for various soil types should be continued and expanded.
- A comprehensive Water Act should be introduced at an early date so that the taking of water for all purposes may be controlled and allocated in the best interests of all sections of the community.

The report is available from the Government Printer, at 1s. 6d. a copy.

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Green feed oats, one of a wide range of fodder crops suitable for Canterbury conditions. Cereal crops for green feed are likely to be more reliable than grass mixtures when the sowing has to be made late in the season.

moisture is adequate, wheat stubble will be burnt off and the land surface worked and autumn sown to grass with 1 cwt per acre of ammoniated superphosphate. Under less favourable conditions sowing down will be delayed for a year and the wheat crop will be followed by green feed and a summer fallow before going back to grass.

Roots, chou moellier, and kale for winter feeding are usually sown after old pasture, and on suitable land may be followed by a cash crop of oats, barley, or linseed.

Though green feed cereals usually follow a cash crop, they are occasionally used on the first furrow and frequently are sown into disced rape stubble, when the combination of second growth rape and cereal gives a useful bulk of feed at comparatively low cost.

Brassicas are usually sown as a first crop after grass, but may also be used at the other end of the rotation by the addition of light seedings of roots, rape, or chou moellier to the permanent pasture mixture.

Utilisation

During the period from weaning to flushing, when ewes are producing nothing but wool, a maintenance ration only is required and the flock can be run on relatively bare pastures provided ample drinking water is available. Threshed ryegrass or cereal straw may be fed if necessary. Ewes which have reared twin lambs may be rather low in condition and need somewhat better fare, but should not be improved beyond good store condition.

For six weeks (three weeks before mating and three weeks after the rams go out) flushing feed is necessary. Second growth rape or saved grass or lucerne are commonly used, though in a dry season silage, being a succulent, would be equally effective.

From mating to late pregnancy the flock can again be kept on a fairly tight ration and winter feed crops, hay, and silage should be fed in quantities sufficient for maintenance.

On properties where flock replacements are bred turnip tops are usually fed to ewe hoggets before the ewes are turned on to eat the bulbs. All winter forage crops should be fed in breaks, and to maintain stock in healthy condition and avoid waste it is advisable to provide a run-off to pasture on which hay is fed. Sheep are sometimes left on crops such as turnips and swedes for weeks, but this frequently results in digestive disorders and always in waste of feed.

Lambing should be timed to have the maximum number of lambs away as fats before dry weather sets in. This means that ewes are lambing while pasture growth is still backward. The feed supply should be gradually improved in both quality and quantity for four or five weeks before lambing. It is over this period that the farmer who has planned his feeding programme wisely reaps his reward.

In late pregnancy the condition of ewes can be improved by a generous ration of good hay or silage while they are still on turnips or chou moellier. In a normal season and with sound planning these crops are finished before the latest mob of ewes begins lambing, and green feed, young grass, or saved pasture, supplemented by high-quality hay or silage, is excellent fodder to carry ewes and lambs until pasture growth is adequate. Ewes with the most forward lambs should be especially well catered for in an endeavour to send the first draft away fat off the mothers as soon as possible.

The mothers of lambs drafted before weaning, plus any dry ewes, should be separated from the mob and shifted to inferior pasture. Research and farmers' practical experiences have demonstrated the substantial saving of fodder when early weaning is practised. In an average season there appears to be no advantage in postponing weaning after lambs are 12 weeks of age.

Lambs which are not fat at weaning should be turned on to clean, fresh pasture. Some will be finished on supplementary crops, but with full utilisation of pasture and lucerne the area sown in fattening feed will be reduced.

Because they are more reliable than swedes on the light soils of Canterbury and are high yielding, turnips are widely grown for winter feed despite their proneness to attack by cauliflower mosaic disease and insect pests.

FACIAL ECZEMA RESEARCH

Intensive Coordinated Investigations Since Fungus Discovery

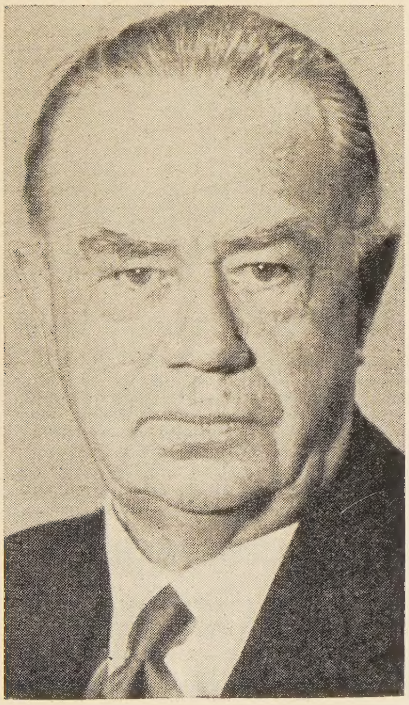
A DRAMATIC advance in facial eczema research was made with the discovery in 1958 that the fungus *Sporidesmium bakeri* caused typical facial eczema symptoms and liver damage in experimental animals.

This knowledge gave a new orientation and incentive to work on the disease. In the 18 months since the discovery was made many organisations concerned with agricultural research have been working in a highly organised coordination of investigations.

In papers to this year's Massey Sheepfarmers Meeting Dr J. F. Filmer, Director of the Animal Research Division of the Department of Agriculture, and Dr A. T. Johns, Director of the Plant Chemistry Division, Department of Scientific and Industrial Research, outlined progress to date and the directions in which research is continuing.

In the Department of Agriculture

Dr Filmer



THE idea that a fungus might be the cause of facial eczema is of course not new. It was commonly mooted during the serious outbreaks in 1938 because of the abundance of mushrooms and other fungi in affected paddocks. A survey of fungi was made at that time and tests were conducted with some of those found. The negative results obtained prompted the hypothesis that the liver-damaging factor was formed in one or more pasture species after warm autumn rains. In 1941 liver damage was produced in experimental lambs fed fresh-cut pasture and in 1943 similar results were obtained with heat-dried pasture.

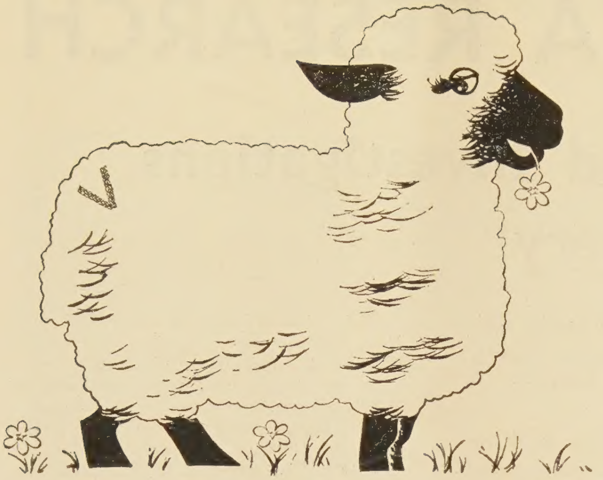
Intensive chemical investigations have shown that the liver-damaging factor could be extracted from affected pasture. These extracts, after being concentrated and purified until they contain as little as 1/70,000 of the original dry matter, are still capable of producing liver damage in guinea pigs and other experimental animals. In the course of this work the chemical test known as the "beaker test" was devised which is capable of estimating the concentration of the liver-damaging factor with reasonable accuracy.

This line of attack diverted attention from the fungus hypothesis, though it was revived from time to time by some workers. In February 1957 an active search for fungi or other organisms in soil and pasture was begun by officers of the Soil Bureau, Department of Scientific and Industrial Research, working in collaboration with officers of the Department of Agriculture, and this led to the dramatic discovery in March 1958 that spores of the fungus *Sporidesmium bakeri* gave a strong beaker test.

It was soon shown that a high sporing strain of this fungus caused typical liver damage in guinea pigs and lambs and produced all the usual symptoms of facial eczema in one experimental lamb. This exciting story has been well told elsewhere ("Journal of Agriculture", October 1958, page 328), and Dr Johns in his paper which follows gives some background data to the discovery.

Some of the implications of the discovery of the fungus could best be discussed by posing certain questions and giving such partial answers as are at present available.

1. **Is the liver-damaging factor in the fungus the same as that in pasture?**
2. **Is the fungus the cause of facial eczema in the field?**
3. **What factors influence the abundance and toxicity of the fungus.**
4. **How can the fungus be controlled?**
5. **How does the liver react to the fungus?**
6. **Can stock be protected against the fungus?**



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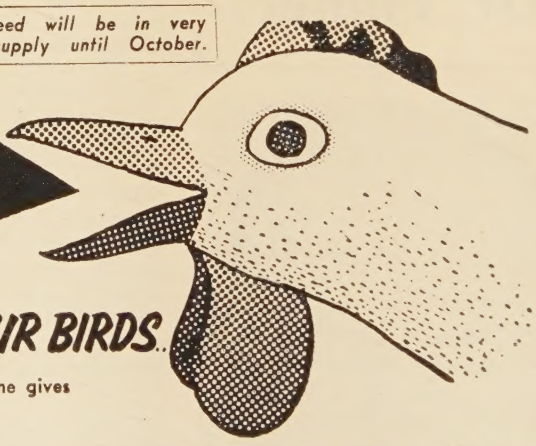

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In 1941 liver damage was produced in experimental lambs fed fresh-cut pasture and in 1943 similar results were obtained with heat-dried pasture. In the lamb above symptoms were produced in 1958 by feeding it fungal material.

Before these questions can be answered completely it will be necessary to learn a great deal about the fungus itself; for example, we must find out how to grow the fungus in quantity, whether the method of growth affects its toxicity, whether spores are the only, or the most, toxic part, and how we can measure the abundance and toxicity of the fungus in the field. Partial answers to these questions have been obtained and Dr Johns deals with some of them.

1. Is the Liver-damaging Factor in the Fungus the Same as that in Pasture?

Obviously the complete answer to this question must await the isolation and identification of the liver-damaging factor from both pasture and fungus. However, investigations at Ruakura and Wallaceville have failed to show any difference in the chemical and biological properties of the extracts containing the liver-damaging factor from the two sources.

The concentration of the liver-damaging factor in some cultures of the fungus is very much greater than in the most toxic samples of pasture. This has facilitated the work of the chemists and should result in the isolation of the liver-damaging factor sooner than seemed possible when it had to be sought in pasture.

2. Is the Fungus the Cause of Facial Eczema in the Field?

Again the evidence is incomplete. However, the fungus has always been found when sought for on pasture which has produced liver damage. At Manutuke during 1959 it was possible to compare liver damage in grazing lambs with spore counts and beaker tests on the pasture grazed by them. There was a very good general correlation between these three measures of toxicity.

Thus, though it is not yet possible to say that facial eczema never occurs in the absence of the fungus, all the available evidence supports the idea that the fungus does cause facial eczema in the field.

3. What Factors Influence the Abundance of the Fungus?

Much of the work on the effect of weather, pasture species, and litter has been done by branches of the Department of Scientific and Industrial Research and Dr Johns's paper tells how these factors affect the abundance of the fungus.

At Manutuke two paddocks were mowed regularly from October 1958 onward at intervals of one to three weeks according to the growth taking place. The pasture was never allowed to become more than 2 in. high. All the clippings were left on one paddock and those collected in the catcher were removed from the other. Another paddock was severely harrowed at weekly intervals from late January to mid March. From early January pasture samples were collected at weekly intervals from these and other paddocks and sent to the Soil Bureau, Taita, where spore counts were made. These were much higher on mowed and harrowed paddocks than on untreated paddocks.

Severe liver damage occurred in nearly all the lambs grazing the mowed paddocks during January and February and 35 per cent of them developed skin lesions. Severe liver damage and skin lesions also occurred after harrowing. Mowing and harrowing both caused a rise in beaker tests. It is presumed that both treatments increased the abundance of the fungus by providing litter on which it could grow.

4. How Can the Fungus be Controlled?

Reports that facial eczema had been prevented by topdressing with copper and cobalt led to the testing of this treatment at Manutuke in the autumn of 1957. Five 1-acre paddocks carrying a similar sward were topdressed as follows: No topdressing; 2 cwt of superphosphate; 2 cwt of superphosphate + 5 lb of copper sulphate; 2 cwt of superphosphate + 5 oz of cobalt sulphate; 2 cwt of superphosphate + 5 lb of copper sulphate + 5 oz of cobalt sulphate. Topdressings were applied on 11 January and each paddock was set stocked with 12 lambs from 14 January to 14 May, when all lambs were killed and their livers examined with the following results:

Treatment	Liver damage		
	None	Slight	Severe
No topdressing ..	4	7	1
Superphosphate only ..	2	7	2
Superphosphate + copper	2	8	1
Superphosphate + cobalt	2	9	1
Superphosphate + copper + cobalt ..	3	7	2

It is thus obvious that topdressing with safe amounts of copper either with or without cobalt cannot be relied on to prevent facial eczema. There is a good deal of field evidence to support this conclusion.

In the following year topdressing with a total of 27 lb of copper sulphate per acre was tested in an effort to confirm the results of an experiment reported by Dr Johns. No liver damage occurred in lambs grazing either the treated or untreated paddocks. The copper concentration in the livers of all the lambs grazing the treated paddock reached a dangerously high level.

In 1959 tests were made at Manutuke with three different fungicides which had proved toxic to the fungus in the laboratory. All appeared to be without effect in the paddock even when applied repeatedly. The use of fungicides is beset by many difficulties. To be effective the time of application may have to be calculated very accurately and they may need to be applied at short intervals.

Most fungicides are quite toxic; 1/10 oz of one of those used killed a lamb in less than 24 hours. A total of 7 lb per acre of this fungicide in three applications was ineffective in controlling the fungus. Enough fungicide to kill over 1,000 lambs was applied per acre over a period of two months.

A culture of a soil organism, *Bacillus subtilis*, which had prevented the growth of the fungus in culture was also ineffective in the paddock, as was topdressing with ½ ton of slaked lime per acre and 6 cwt of superphosphate per acre.

At present there is no safe method which can be recommended for controlling the fungus, nor is it easy to visualise any way in which it could be controlled. However, it is being studied intensively in both the laboratory and the field and this should result in a better understanding of the conditions which favour or hinder its growth. Such an improved understanding may indicate a method of control.

5. How Does the Liver React to the Fungus?

For many years the changes in the liver have been studied in natural and experimental cases of facial eczema in sheep, cattle, and guinea pigs. However, until the discovery of the fungus it had never been possible to give graduated doses of the liver-damaging factor to a large group of animals and kill them at short intervals to discover just how the liver reacts. Now that large quantities of fungus cultures are available such experiments can be undertaken. Already one experiment involving over 200 guinea pigs has been conducted and similar experiments with mice, rats, rabbits, and lambs have been started or are planned. Culture material or extracts of it are being given both by mouth and by injection into different sites including the gall bladder and the vein leading to the liver.

These experiments are very important. Until we can measure accurately the effect of a known dose of liver-damaging factor on experimental animals it will not be possible to calculate the effect of measures designed to protect these animals.

In addition to experiments with animals the effect on cultures of living cells is being studied. If successful, this method would enable the toxicity of an extract to be measured quickly, only very small quantities being used.

6. Can Stock be Protected against the Fungus?

Two avenues are being explored, antidotes and vaccines. Antidotal treatment probably has little hope of success as a practical measure. An antidote must usually be given before, with, or immediately after the poison, and with grazing animals this presents obvious difficulties. The discovery of a successful antidote would, however, be of considerable value in aiding our understanding of the disease. Since the discovery of the fungus, vaccination has become a real possibility, as some fungi are known to provoke the formation of antibodies. This question will be thoroughly explored, as vaccination would be a very practical way of controlling the disease.

Conclusion

Though no new way of controlling the disease has yet been found, the discovery of the fungus has opened up many new lines of attack and one or more of these may well prove fruitful.

In the meantime farmers are recommended to use the control measures which, in spite of their obvious disadvantages, have been successful in preventing any outbreak of facial eczema at Ruakura during the past 16 years.

In the Department of Scientific and Industrial Research

Dr Johns

INVESTIGATIONS of the causes of the very severe outbreak of facial eczema in 1938 were believed to have eliminated the possibility of a micro-organism as the culprit and it was considered that by far the most probable cause was a toxin in the pasture herbage induced by abnormal growth conditions. This was believed to be just one more link in the chain of observations that rapidly growing pasture plants can cause serious disorders of livestock. It was considered that facial eczema was in the same category as bloat and staggers in being associated with abnormal growth conditions.

The Plant Chemistry Laboratory, Department of Scientific and Industrial Research, was established in 1938 under Dr J. Melville to study the relationship of problems such as these to the biochemical processes of pasture plants, with special reference to facial eczema.

Regular meetings of facial eczema workers from both the Department of Agriculture and D.S.I.R. were held for several years, but as Dr Melville left the Plant Chemistry Laboratory for war service, and the laboratory was diverted to defence priority work, D.S.I.R.'s participation gradually decreased and ceased altogether in 1945.

The Department of Agriculture continued the work at Wellington and later at Ruakura, hampered both by the lack of supply of toxic grass and a suitable assay procedure for the toxin.

Large-scale Extraction of Toxic Grass

In 1957 a large amount of facial eczema toxic grass was collected at Manutuke and other Hawke's Bay farms. Dr J. F. Filmer offered the D.S.I.R. 5 cwt of dried grass so that they could again participate in the facial eczema research programme. Dr E. P. White at Ruakura had by this time reached the stage where it was possible to produce as a routine small-scale procedure a concentrate containing 1/20,000 of the original weight of grass. After consultation with the Ruakura workers it was decided that, rather than work independently, the Plant Chemistry Division could best help the programme on the isolation

▲ Mass production of *Sporidesmium bakeri* in a culture room at the Soil Bureau, Taita.

of the toxin from grass by putting Dr White's procedure on a large scale.

Some of the procedures that were used in the laboratory could not be scaled up to handle large quantities of materials. Over a period of several months modifications were made and checked by guinea pig testing. Finally a large-scale process at least as good as Dr White's original procedure to the 1/3,000 stage and capable of handling 40 lb batches of grass was developed.

The discovery in 1958 that facial eczema could be caused by a fungus changed the picture radically in that the chemists were no longer dependent on grass collected in the field as a source of starting material. However, some 450 lb of grass was processed to provide enough material so that when the toxic substance is finally purified from the fungus its identity with the material isolated from toxic grass can be established.

Discovery of a Fungus as Cause of Facial Eczema

The events leading to the discovery of the fungus were the result of several years' intensive work by Dr R. H. Thornton and his team at the Soil Bureau, Taita.

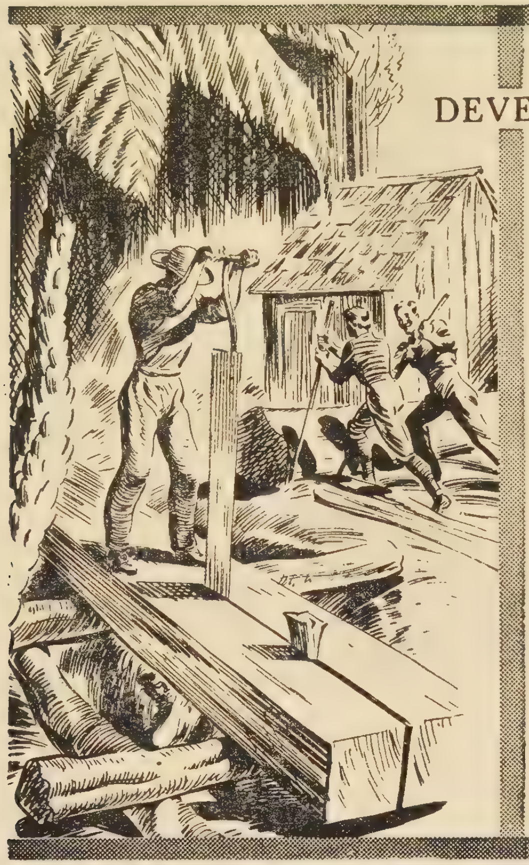
The microbiology team at the Soil Bureau set out to gain a broad picture of the soil micro-organisms in New Zealand. Two projects were drawn up, firstly to study micro-organisms under tussock grassland and the exotic pasture that is replacing it, and secondly to study the micro-organisms under forest and the exotic pasture in the same way.

By the end of 1956 the first project had been completed and Dr Thornton and co-workers began to think seriously of the micro-organisms associated with grass roots and, because of observed marked seasonal peaks in microbe numbers, resurrected the theory that soil microbiology might play a part in the facial eczema problem.

As a result of discussions with Dr Filmer and Dr C. P. McMeekan it was decided during 1957 to include some of the facial eczema areas in the microbiological examinations. Hence samples were examined from Claudelands showgrounds, Judgeford, Marton, and Palmerston North. As the samples were collected it was the task of the microbiological team to identify the many species present and to select those organisms which showed a significant increase in population before or at the time of the production of toxic grass. These selected organisms were grown on various media and given a preliminary screening for toxin (a) by the beaker test at Ruakura and (b) by feeding to guinea pigs at Taita. Some 4,500 isolates (80 species) were made from the soil and grown in culture, and some 1,500 were cultured from pasture leaves. Approximately 1,000 soil isolates were cultured from Claudelands alone.

Among the first micro-organisms that attracted attention was a new species of red yeast *Rhodotorula gramins.* It reached its peak of numbers on the dry pasture just before the first autumn rains and in some samples comprised up to 1 per cent of the weight of pasture (100 million per gram of pasture). This organism pro-

▼ Jar containing 3 oz of sooty spores of *S. bakeri* produced at the Soil Bureau on 26 March 1959 and found to be highly toxic.



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duced large amounts of fat. Three preliminary feeding trials all gave negative results.

Meanwhile in May 1957 Dr. K. J. Mitchell, after claims by certain farmers that copper sulphate topdressing prevented facial eczema, reported results of a small experiment with lambs on plots with topdressing which included 30 lb per acre of copper sulphate. Though a dangerously high copper level was reached in the lambs, his results tended to confirm the farmers' claims. Owing to the well known fungicidal properties of copper sulphate, this experiment gave renewed hope to the Taita team, who at this stage were considered to be following a very long shot.

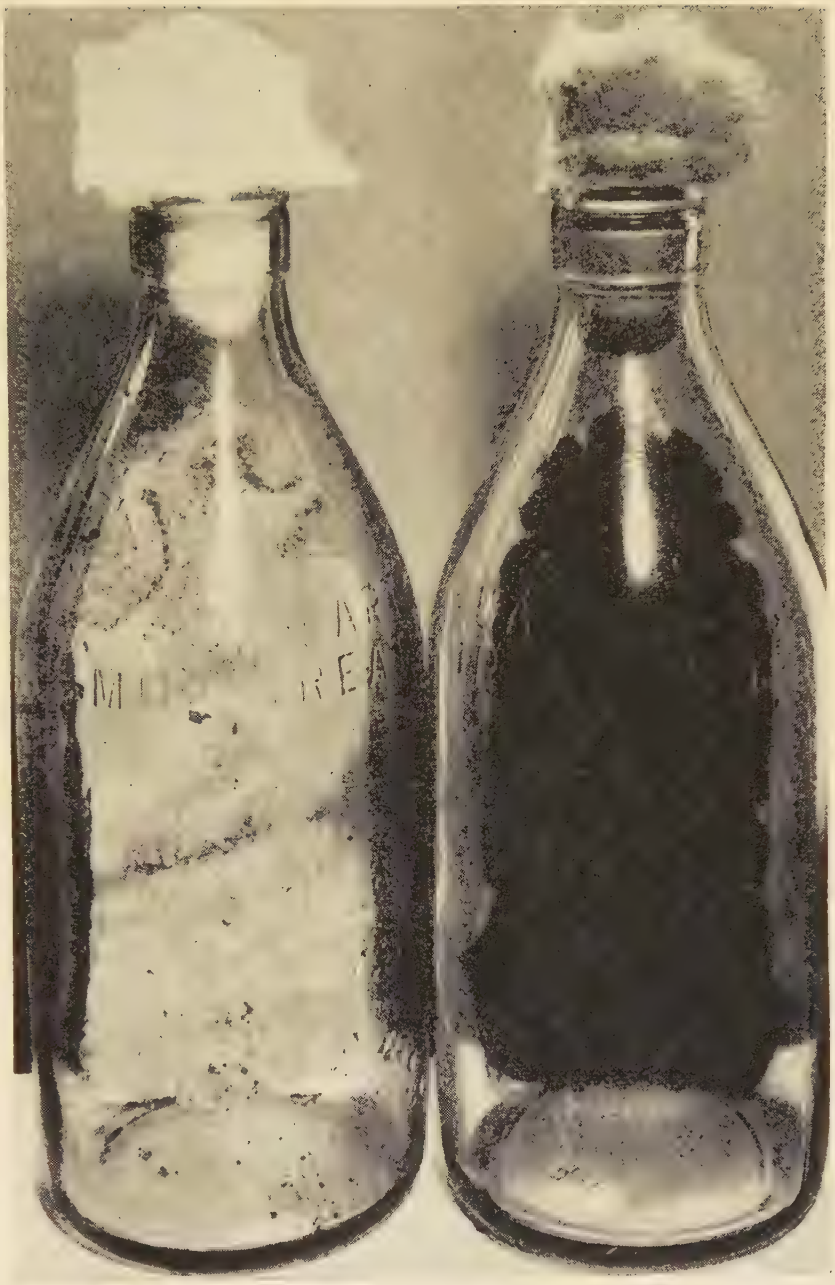
In March 1958 Mr J. C. Percival observed mycelia on the Claudelands plot and sent Dr Thornton samples which contained the mycelia of several fungi. Of these *Stemphylium botryosum* was the most common.

A few days later Mr Percival collected from the blades of a mower a sample of spores which were present in large numbers on the Claudelands plots, and realising its possible significance had it checked for beaker test. The result was positive. The spores were identified by Dr Thornton as those of *Stemphylium botryosum*, later renamed *Sporidesmium bakeri*. It was therefore tempting to speculate that since the spores of *Sporidesmium* had reacted to the beaker test, the same organism might also at some stage of its growth produce the toxin.

In May, to check the reaction of *Sporidesmium* and other fungi to the beaker test, *Sporidesmium* was grown on sterilised non-toxic grass, on dead ryegrass roots, and on nutrient solution, and, with six other fungi, was sent to Ruakura for beaker test. All were negative, as were the feeding tests to guinea pigs at Wallaceville.

At this stage Dr Thornton examined samples of toxic and non-toxic grass from Dr G. W. Butler from our trial area at Massey. Large numbers of *Sporidesmium* spores were present on the toxic grass samples, whereas on non-toxic grass samples the numbers were considerably fewer. Dr Thornton therefore went on with trials of these organisms and because of the large numbers of spores present on grass samples selected a high sporing strain. At last a positive beaker test was obtained from Strain C grown on potato-carrot media.

His cultures of *Sporidesmium bakeri* Strain C grown on potato-carrot media at Taita and Ruakura Research Stations were fed to guinea pigs at Ruakura. The results were positive. Later liver damage typical of facial eczema was produced in a lamb fed on the fungal material. It was now clear that the micro-organism *Sporidesmium bakeri* could produce the disease known as facial eczema.



Two strains of *S. bakeri* isolated and grown at the Soil Bureau, Taita. Left is a low sporing, low toxin producing strain and right a high sporing, high toxin producing strain.

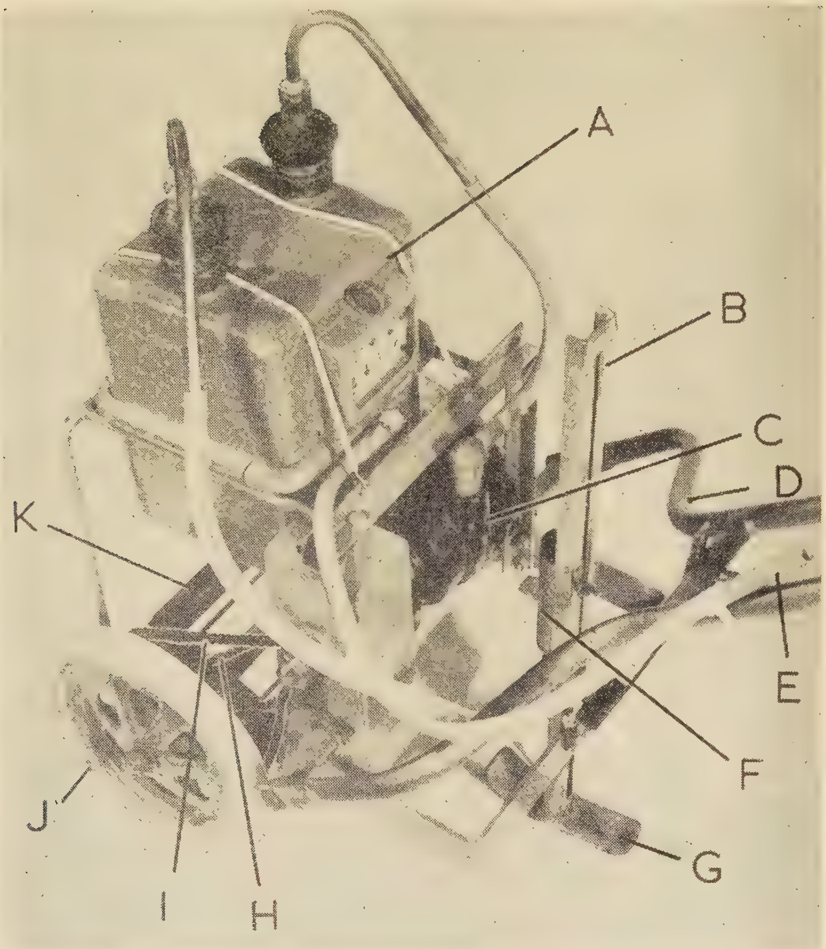
This discovery did not of course mark the end of the research programme. It marked the beginning of a more intense programme involving a large number of workers in all the various phases that needed to be studied.

CURRENT WORK

The Divisions of D.S.I.R. now engaged in research into facial eczema include:

1. Plant Diseases Division, Auckland
2. Soil Bureau, Taita
3. Grasslands Division, Palmerston North
4. Plant Chemistry Division, Palmerston North
5. Dominion Laboratory, Wellington
6. Fats Laboratory, Wellington

where some 16 professional officers have been concerned with various aspects of the work over the past year.



Spore trap for sampling pastures. A—Gas meter to measure the volume of air taken into the impactor (F). B—Track for adjusting height of impactor. C—Suction pump driven off wheels by chain (I). D—Lawn mower handle. E—Air exhaust tube. F—Impactor, in which is a sticky microscope slide so placed that spores sucked in through a narrow slit on the front of the impactor are caught in a narrow band on the slide. (The spores are counted afterward with a microscope.) G—Skid to keep impactor at a steady height above ground. H—Beater drive chain. I—Pump drive chain. J—Wheel. K—Beater, driven off the wheels, to disturb spores in the pasture.

Microbiology

Plant Diseases Division and Soil Bureau are mainly concerned with a study of the fungus itself: its taxonomy; what it grows on in the field; the optimum conditions for its growth in culture and maximum spore production; whether toxin production varies with strain and conditions of growth; how best to grow it on a large scale to produce extracts for the chemists to work.

Techniques for sampling paddocks to indicate how much fungus is present have been developed at both institutions.

Sporidesmium bakeri was first reported from banana leaves from the Philippines in 1914. It has since been reported from the tropics as occurring on rice, maize, sorghum, pigeon peas, and palm leaves. The fungus is a saprophyte which appears to be able to grow on just about any dead plant material.

Miss J. M. Dingley in her search for strains in New Zealand has noted the following host plants on which colonies of this fungus have been found: Yorkshire fog, ryegrass, cocksfoot, tall fescue, prairie grass, browntop, paspalum, clover (both red and white), *Lotus* species, plantain, dock stalks, fennel stems, and damaged potato leaves.

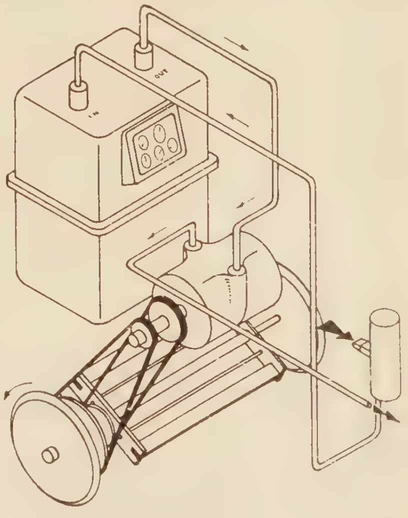
Field studies by Dr P. J. Brook confirm the findings that *S. bakeri* colonises dead material of practically all herbaceous plants found in pastures. A combination of relatively high temperatures, humid conditions, and the presence in abundance of dead plant material provides maximum conditions suitable for maximum growth and sporulation of the fungus. Dr Brook has found that the spores of *S. bakeri* are distributed through the air in dry and windy periods. During the day they are a more or less constant feature of the air flora, unless it is raining. He has developed a volumetric spore trap for sampling paddocks, but data obtained with this instrument still have to be correlated with spore counts from comparable grass samples and with the occurrence of facial eczema.

Dr Thornton at Soil Bureau has also been concerned with the development of a spore counting technique that has been applied to samples from a number of locations including the Department of Agriculture trial area at Manutuke.

Results suggest that the provision of freshly cut or freshly damaged plant material, either by mowing or harrowing, induced a high spore count. The fungus was observed to colonise recently cut grass and the cut edges of growing grasses.

Face wool taken from sheep on one of the fields gave a very high spore count. Hence there is the possibility that the sheep itself may provide a quick field method of sampling for the presence of spores of *S. bakeri*.

In a pure perennial ryegrass area at Palmerston North, run jointly by Massey College and Plant Chemistry and Grasslands Divisions, Dr Thornton found a moderate spore load. However, on a strip which was mown across the field, the count went up very markedly within a few days. On an adjoining paddock where short-rotation ryegrass was practically wiped out by an attack of Argentine stem weevil no *S. bakeri* was detected



Flow diagram of the spore trap, with arrows showing the path of air from the impactor to the exhaust.

despite the provision of adequate dead short-rotation ryegrass. In the perennial ryegrass area evidently both the microclimate and food supply were favourable to *S. bakeri* growth, whereas in the short-rotation ryegrass the food was present, but due to complete killing of nearly all herbage the microclimate was not.

In Dr Thornton's sampling a tenfold variation between samples was detected across the paddocks. This illustrates how localised the infection may be.

Dr D. J. Ross at Soil Bureau has been investigating the effect of various cultural conditions on toxin production and will be trying out various strains of the fungus to see how they vary with regard to the amount of toxin they produce.

So far, almost all the fungus has been grown in liquid culture on an extract of potatoes and carrots. This extract can vary according to the manner in which it is made. Therefore, it is preferable to have a medium in which all the constituents can be added in weighed amounts as pure chemicals. We then know that we have a completely reproducible growth medium. Dr Ross is working on this in conjunction with Wallaceville, who carry out the animal testing for toxicity. He is cooperating with Mr I. R. C. McDonald of Dominion Laboratory in an examination of the metabolic products of the fungus.

The fungus being grown at the Soil Bureau, Taita, in liquid culture on an extract of potatoes and carrots.

Part of the toxin appears to be in spores of the fungus and part in the mycelium and culture fluid when the *S. bakeri* is grown on liquid media. It has not been finally determined whether spores alone or the whole culture are the best material for the chemists to use for the extraction of the toxin. Dr T. R. Vernon at Plant Diseases Division has been doing somewhat the same work as Dr Ross, but has concentrated more on a method of producing large quantities of spores. He has found that spores from the fungus after seven days' growth on sterilised ryegrass when tested by guinea pig feeding were highly toxic. Dr Vernon has by his technique produced over ½ lb of spores for the chemists at Ruakura.

Soil Bureau has grown a large amount of fungal material for Ruakura and Wallaceville Animal Research Stations, the Dominion Laboratory, and the Fats Research Laboratory.

Work at Grasslands

At Grasslands Division Dr Mitchell collected information for weather records and in conjunction with Mr T. O. Walshe of the Meat and Wool Boards and Mr N. G. Robertson of the Meteorological Service suggested a method of assessing the likelihood of time of commencement of facial eczema outbreaks. He also tried out the technique of spraying the pasture with copper sulphate to control the disease. The experiment was successful, though from the practical point of view the level of copper in the liver of the animals from the sprayed area was near the lethal level. This last season Dr P. D. Sears and Mr V. C. Goodall have repeated this trial with a greater number of animals. In this case 8.0 lb of copper sulphate was applied in five dressings between 11 December 1958 and 19 February 1959. The essential aim was to obtain a prevention of the build-up of fungus.

Between 26 February and 4 March, of 16 animals on the unsprayed area, all showed liver damage, while only one of 14 on the sprayed area did so. As with Dr Mitchell's trial the lambs on the sprayed area showed high liver copper levels.

From the laboratory and glasshouse work done by Dr Brook at Plant Diseases and Mr B. S. Janes (seconded from Imperial Chemical Industries Ltd.) at Grasslands, it would be expected that the amount of copper applied would not in fact reduce the fungal population. The only other explanation appears to be that the copper has in some way protected the animals from liver damage. It is obvious that this work will have to be repeated and extended.

In the meantime farmers should not use copper sulphate as a preventive measure in view of its toxic effect on the animal.

Dr Mitchell was able to establish *S. bakeri* on ryegrass in his controlled environment glasshouses. These were of considerable use in supplementing field observations on the habits of the fungus and for fungicide trials. The results with fungicides at Grasslands and Plant Diseases Division do not give much hope that their use will lead to a practical method of control in the field.

Dr P. C. Barclay of the Plant Breeding Section, who set out to determine whether there were any pasture plants on which *S. bakeri* did not grow, so that perhaps a safe pasture could be recommended, found, as did others mentioned above, that the fungus grew well and spored profusely on dried leaves of practically all species. Yorkshire fog, of the grasses, supported the most prolific growth, while suckling clover and *Lotus ulginosus* were the most susceptible legumes.

The fungus grew and spored well on the fresh damaged leaves of many species, while on others such as sweet vernal and white and red clovers the fungus behaved as though they contained inhibitors to its growth. The expressed juices and extracts of these have been tested and antifungal substances shown to be present. Red clover and sweet vernal have been selected for further studies. Dr E. Wong of the Plant Chemistry Division is undertaking chemical studies to isolate and characterise the active antifungal principles.

Plant Chemistry Division

The large-scale extraction of toxic grass carried out by Mr J. G. Fraser has already been mentioned as has work on the extraction of antifungal materials from pasture species. Dr Butler is interested in the chemical composition of rapidly growing ryegrass, particularly in connection with the hogget ill-thrift problem. This work, however, is also of interest from the point of view of nutrition of the fungus.

It has not yet been finally determined whether the sheep obtains all or only part of the toxin from the ingestion of spores. Dr Butler is conducting experiments to see whether the toxin can be taken up by grass roots and translocated to the green leaves of the plant.

Facial eczema has occurred in three successive years on the ryegrass strain trial area and the opportunity has been taken to attempt to correlate beaker test on the grass with toxicity as measured by grazing sheep. One of Dr Thornton's original strains of fungus was isolated from this area on Massey College.

At one stage in the partial purification of the toxin Dr D. D. Perrin at Ruakura showed that evaporation of a particular chromatographic fraction in a beaker left a white deposit. Though the substance responsible was not itself toxic, its presence was found to be a good guide to the presence of toxicity in the sample. The structure of beaker test substance is of importance for the light it may throw on the chemical nature of the facial eczema toxin. Its chemical relationship to other members of its group is also of great interest. Thus, while these latter are all antibiotics, beaker test substance has not so far been shown to have antibiotic activity. Dr D. Russell, one of the four facial eczema fellows appointed by the Department of Agriculture, is working on the problem of elucidating the structure of the beaker test substance and of similar substances from other fungi which can give a false beaker test.

Dominion Laboratory

Most of the facial eczema work at Dominion Laboratory has been carried out by Mr McDonald and involves the use of a double-beam infrared spectrophotometer. This is one of a number of instruments now widely used by organic chemists to help determine what type of chemical compound they are dealing with. The chemists at Ruakura, Soil Bureau, and Fats Laboratory send their extracts to Mr McDonald for examination. It is hoped that some difference may be seen between toxic and non-toxic samples which can give a much simpler index of toxicity than the four weeks' guinea pig test.

Other methods of extracting various strains and examining the constituents are also being employed by Mr McDonald in collaboration with Dr Ross of Soil Bureau. These studies, particularly on the amino acids, may lead to an understanding of how the toxin and beaker test compound are formed. The suggestion is that a closely related series of peptides exists in the fungal extracts and that probably one or several of these is in fact the toxin.

Fats Research Laboratory

S. bakeri, in common with many other fungi, contains fat globules. It is not considered that this fat has anything to do with the toxic principle, but the study of the fat is useful in obtaining a better overall picture of the fungus. The fat composition could help the taxonomist in differentiating strains of the fungus and this could be allied to degree of toxicity.

Fats Research Laboratory also have a specialised piece of equipment which has revolutionised fat analysis in the last few years. The method used is known as gas-liquid chromatography and was developed in part by Dr A. J. P. Martin, who shared with Dr R. L. M. Synge a Nobel prize for their work in other branches of chromatography. Dr J. C. Hawke is the expert on the use of this equipment, while others working on the fungal fat under the direction of Dr F. B. Shorland are Mr L. Hartmann and Dr Isobel Morice.

The work being carried out by the various Divisions has been dealt with separately. It should be emphasised, however, that they are all working together and with the Department of Agriculture. Specialists and special equipment are being employed in their own Divisions rather than one institution trying to obtain all the costly and complicated equipment under one roof. Only part of the work is connected with providing a direct method of control, but all is directed to obtaining as much information as possible about *S. bakeri* and its habits. Sometimes the indirect approach provides the best answer in the long run.

Regular meetings of workers from the Department of Agriculture and D.S.I.R. are held to pass on the recent results. From the amount of effort involved we should not be too long in obtaining an answer to the question "Why of all the possible pastoral areas in the world available for fungal infection does *S. bakeri* cause facial eczema only in New Zealand?".*

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* Reports of facial eczema outbreaks in Victoria appeared in the Press in New Zealand after delivery of Dr Johns's paper above. Little authoritative information on their nature is yet available.—Ed.

Agricultural and Pastoral Show Dates

THE following are dates and venues of A. and P. shows up to the end of December:

NORTH ISLAND

November

4 November—Cambridge A. and P. at Cambridge.

*5, 6, and 7 November—Manawatu and West Coast A. and P. (Royal Show) at Palmerston North.

7 November—Tokoroa A. and P. at Tokoroa.

11 November—Thames Valley A. and P. at Te Aroha.

13 and 14 November—Whangarei A. and P. at Whangarei.

13 and 14 November—Wanganui A. and P. at Wanganui.

*14 November—Clevedon A. and P. at Clevedon.

14 November—Waihi A. and P. at Waihi.

20 and 21 November—Egmont A. and P. at Hawera.

*21 November—Bay of Islands P. and I. at Waimate North.

21 November—Rotorua A. and P. at Rotorua.

27 and 28 November—Auckland A. and P. at Epsom.

27 and 28 November—Stratford A. and P. at Stratford.

December

5 December—Kaikohe A., P., and H. at Kaikohe.

5 December—Helensville A. and P. at Helensville.

5 December—Hauraki A. and P. at Paeroa.

SOUTH ISLAND

November

*11, 12, and 13 November—Canterbury A. and P. at Christchurch.

14 November—Tokomairiro A. and P. at Milton.

18 November—North Otago A. and P. at Oamaru.

20 and 21 November—Nelson A. and P. at Richmond.

21 November—Waimate A. and P. at Waimate.

21 November—Courtenay A. and P. at Kirwee.

*21 November—West Otago A. and P. at Kelso.

24 and 25 November—Timaru A. and P. (South Island Championships) at Timaru.

*28 November—South Otago A. and P. at Balclutha.

28 November—Motueka A. and P. at Motueka.

December

1 and 2 December—Gore A. and P. at Gore.

5 December—Wyndham A. and P. at Wyndham.

5 December—Otago Peninsula A. and P. at Portobello.

*11 and 12 December—Southland A. and P. at Invercargill.

* The Department of Agriculture exhibit will be staged at this show.

Wool Sales

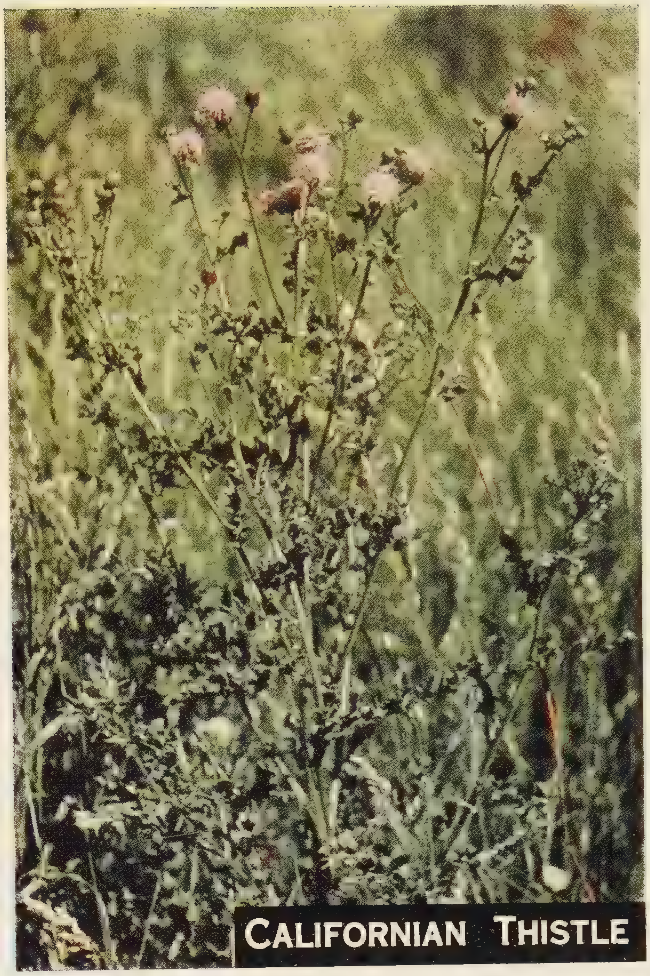
The dates and venues of wool sales up to the end of December are:

9 November: Auckland.
13 November: Wanganui.
18 and 20 November: Napier.
25 November: Wellington.
4 December: Christchurch.
9 December: Invercargill.
14 December: Dunedin.
18 December: Timaru.

WEED IDENTIFICATION AND CONTROL

By L. J. MATTHEWS,
Senior Scientific Officer,
Department of Agriculture,
Wellington

This is one of a series of articles illustrated in colour to appear in the "Journal" from time to time in which identification and control of various weeds will be discussed.


CALIFORNIAN THISTLE

CALIFORNIAN thistle (*Cirsium arvense*), one of New Zealand's worst weeds, is widely distributed, except in North Auckland, in pastures, waste areas, and crops. It competes with good pastures, spreading by seed and underground rhizomes and is difficult to eradicate in established pastures.

CALIFORNIAN thistle, also known as Canadian thistle, field thistle, etc., belongs to the daisy family (Compositae). It is dioecious, that is, the male and female organs are produced on separate plants, often in separate colonies. The above-ground parts, which can reach a height of 5 ft, die back each autumn.

Control of Established Plants

Established plants in old pasture are difficult to control selectively. Ploughing up and cultivation of the old pasture and treatment of regrowth would give better control. However, if control without taking the pasture out of production is to be attempted, repeat applications of MCPA, 2,4-D or MCPB, and 2,4-DB will be required annually. The first application should be made after the plant has reached the maximum leaf stage, that is at flower stalk initiation, with the water-soluble phenoxyacetics and phenoxybutyrics. If the application is delayed until the early seed-head stage, best results are obtained with emulsifiable esters of 2,4-D.

Alternatively the thistles should be mown and treated in autumn with salts and amines of 2,4-D, MCPA, MCPB, or 2,4-DB. Normal rates of application are 1 lb per acre for the phenoxyacetics and 1 to 2 lb for the phenoxybutyrics.

Control in Young Pastures

Californian thistle is best controlled in newly established pastures or in hormone-resistant crops after cultivation. Cultivation should aim at cutting the rhizomes into short lengths to activate growth so that each plant arises from a short root length. After cultivation the thistle is controlled or killed in new pastures by MCPB or 2,4-DB at 1 to 2 lb, in peas by MCPB at 1 lb, in lucerne by 2,4-DB at 1 lb, in cereals by MCPA, 2,4-D, MCPB, or 2,4-DB at 1 to 2 lb, MCPA/TCB (CP 18 : 15) at 4 pints, and 2-(MCPP) or mecoprop at 2 lb, and in maize with MCPB, 2,4-DB or MCPA, and 2,4-D at up to 1 lb. It is not controlled by simazine in maize crops.

In field brassicas Californian thistle is checked by monochloroacetate at 15 lb per acre. It is controlled adequately by 2 lb per acre of amitrol applied with dalapon for turf destruction before pasture and crop establishment. Amitrol at up to 8 lb per acre has given good control in waste areas; 2,3,6-TBA is also promising at up to 20 lb per acre. In waste areas thistle has been killed by the substituted ureas (monuron and fenuron) at over 40 lb per acre. It is more effectively controlled by the more soluble soil sterilants, the chlorates and chlorate/borates, than by the largely insoluble preparations such as simazine and the substituted ureas. Control by these chemicals is more costly than with amitrol or mixtures of amitrol and 2,4-D.

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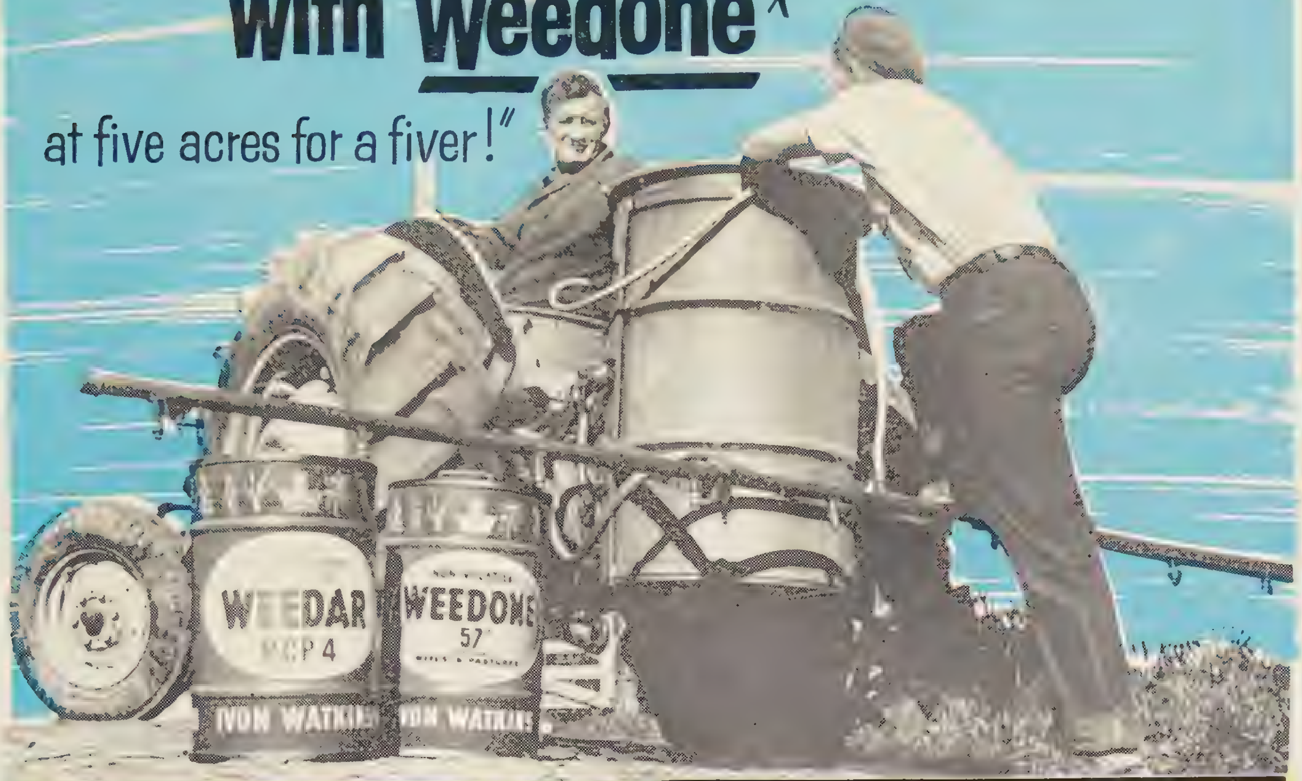

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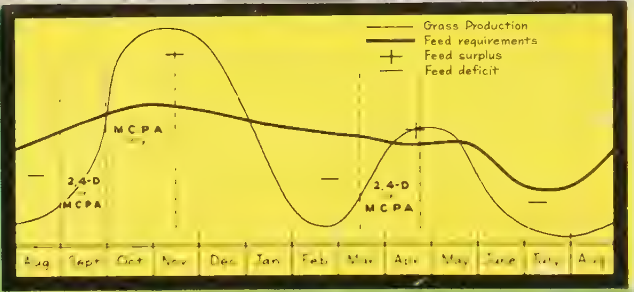

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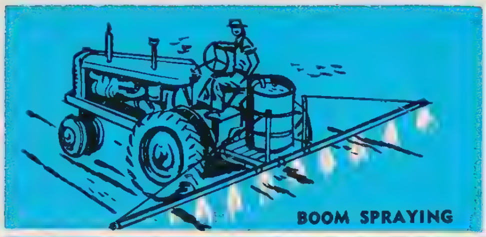
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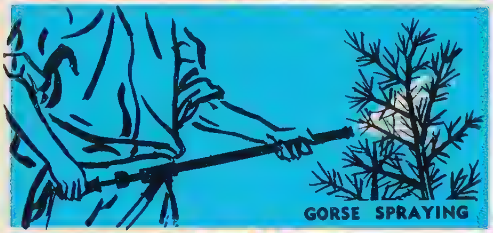
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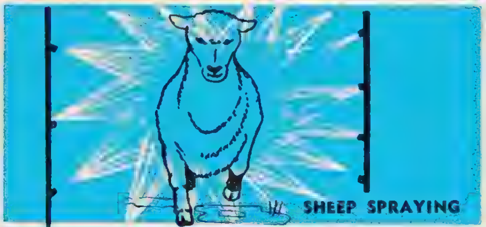
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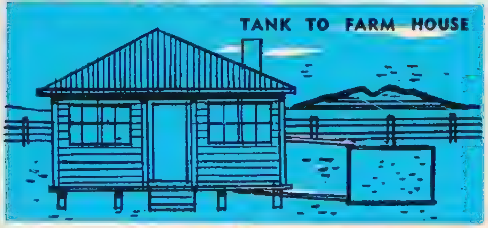
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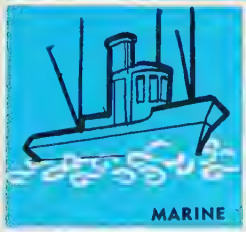
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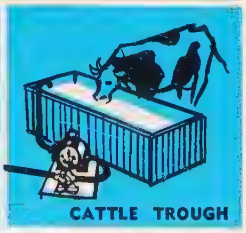
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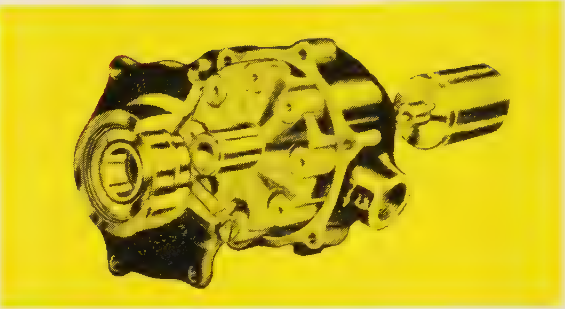

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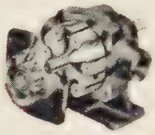

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THOUGH a practical method of improving Canterbury light land soils has been used for many years, the fundamental aspects of this method had not seriously been challenged in the light of more recent knowledge of molybdenum and sulphur deficiencies. This article gives the results of a series of experiments to determine the fertiliser requirements of these soils. The area covered by these experiments is only a small portion of the light lands of Canterbury and, therefore, farmers should seek advice from their local officers of the Farm Advisory Division regarding detailed aspects of their own areas.

By W. R. LOBB,
Superintendent, Department of Agriculture's Winchmore Irrigation Research Station,
and R. L. BENNETTS,
Fields Instructor,
Department of Agriculture,
Christchurch

Fertiliser Responses on Plains Soils of Canterbury

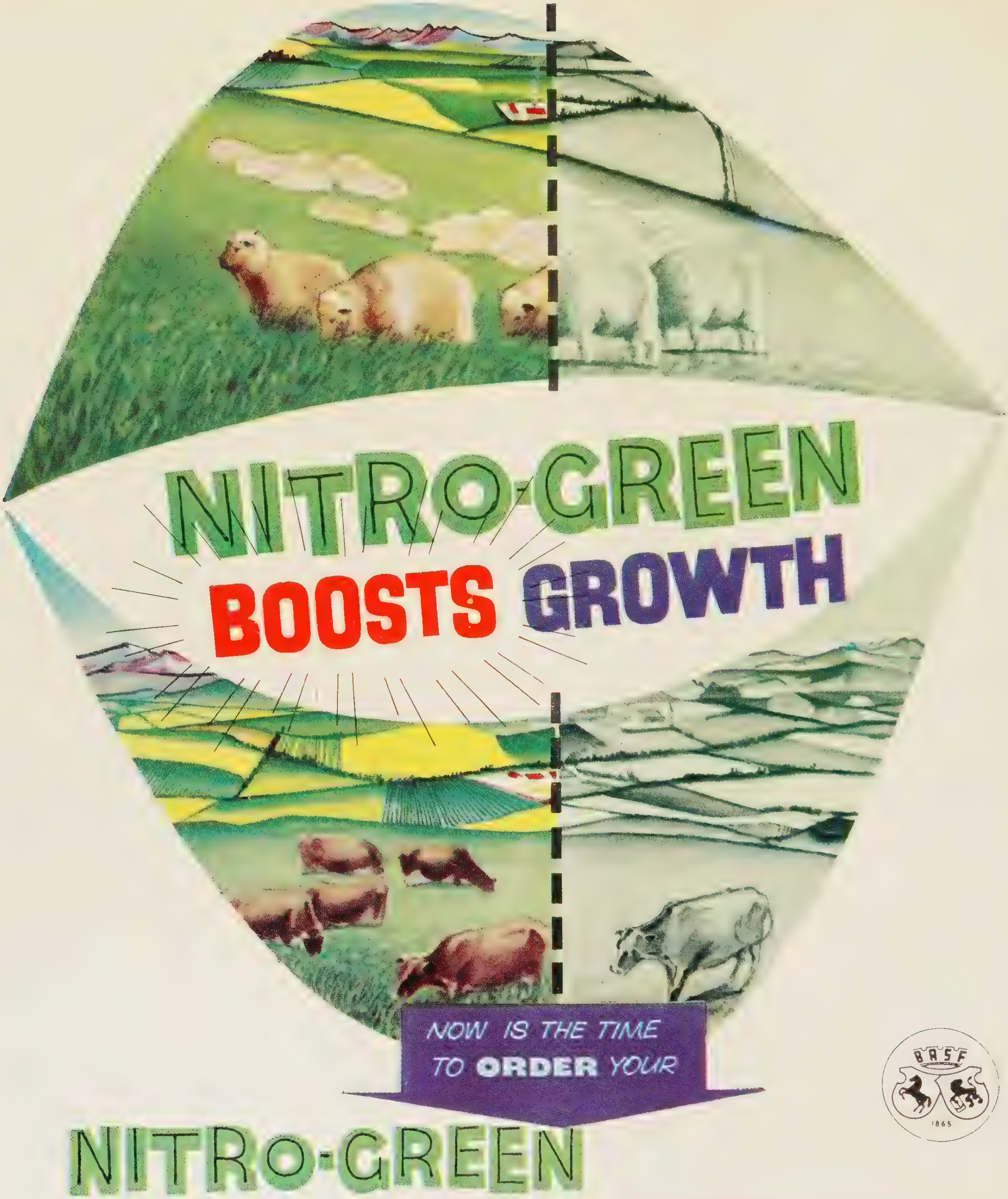
IN the past there has been a steady improvement in the farming of the light land areas of the Canterbury Plains. These areas extend south from below the Waiau River to the Waitaki River with the main areas lying north of Timaru and south of Christchurch. The soils are of the Lismore group and embrace types such as Ruapuna and Ashwick in the higher-rainfall group and Lismore, Eyre, Stewart, and Chertsey in the lower-rainfall group.

Common to all these soils is a shingly porous subsoil with topsoils varying from almost nothing to about 18 in. in some cases. As they stretch from the coast inland for about 50 miles and rise from sea level to approximately 1,000 ft, the effect of climate on their productivity is considerable. Rainfalls are from slightly below 25 in. to slightly over 35 in., generally increasing near the foothills.

The basis of early improvement by the use of subterranean clover, lime, and superphosphate has been fully covered in an article, "Pastures and Farms in Malvern County", in "The New Zealand Journal of Agriculture" of February 1952 and there can be

▲ The effect of sulphur and phosphorus (left) and of sulphur, phosphorus, and molybdenum (right). Nine trials in this series have shown that these soils respond to molybdenum after sulphur and phosphorus deficiencies have been corrected.

← In this trial the effect of molybdenum (in the initial stage of fertility correction) can be compared with that of lime. In some trials the molybdenum response was not far short of that from 1 ton of lime per acre, and when such responses are obtained it would be much cheaper to use molybdenum, and possibly low rates of lime, than to use the high rates of lime frequently used in the past.



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little doubt that all three factors have been effective. Many experiments have been carried out by the Department of Agriculture and in all these lime and superphosphate responses have been of considerable magnitude.

Over the past few years interest in the effects of fertilisers and lime has become more critical and attempts have been made to separate the reasons for their effectiveness. In an early series of trials molybdenum was shown to be of some importance, but its possible role was somewhat discounted because lime was considered necessary in any case and because a number of areas did not respond to molybdenum. Where there was no response to molybdenum many of the areas had already been improved and lime had been used. The reasons for superphosphate responses were not examined until later, and the findings were a result of work on the inland areas and a direct attempt to establish over what range of Canterbury soils sulphur was important. While this factor was being examined opportunity was taken to re-examine the position of molybdenum and lime on these areas.

As with many other areas there is considerable variation in the responses of these Canterbury light land soils to fertiliser treatments. Thus, though lime and superphosphate have been generally recommended for the improvement of nearly all these areas, the rates used have varied considerably. It is probably true, however, that the greatest improvement has accompanied the use of the higher amounts of both lime and superphosphate. There is general acceptance, therefore, that many of these soils require high initial and maintenance rates of lime and that production is dependent on a continued programme of superphosphate topdressing.

Experimental Work

Most experimental work has been concentrated on areas where some improvement has taken place, and in the first instance demand for improved information often comes from the more progressive farmers within an area, so that many sulphur and molybdenum experiments have been on areas already improved with lime and superphosphate. Though these have given some valuable information, it was thought possible that they may not have indicated the true extent of the deficiencies. Previous use of lime will have a real bearing on the results of tests examining molybdenum deficiency, and previous management and use of superphosphate will affect the sulphur status of soils. It was for this reason that it was decided to examine with a series of simple trials a number of unimproved and in many cases undisturbed sites, as it was felt that this would be the only way in which sulphur and molybdenum deficiencies could be quickly detected.

The sulphur and phosphorus strip in one of the trials. Cross treatments of molybdenum (foreground), manganese, copper, and boron have been used. With the exception of molybdenum, boron was the only element which appeared to have a slight effect in some trials, apparently to a greater extent on the limed plots.

A series of 15 trials by one of the authors and a number of trials by several Instructors in Agriculture are considered here to give as complete a picture as possible.

Of the 15 trials mentioned eight were on undisturbed virgin soils and seven on land which may have been cultivated at some time. All areas were of very poor, unproductive browntop, hair grass, danthonia swards and none was on areas which had been cultivated or topdressed in recent years. Trials were sown in winter and all were oversown with red, white, and alsike clovers. It was hoped that if responses were obtained, they would reflect the true deficiencies of these soils in their unimproved state.

The fertiliser comparisons made were: phosphorus alone; sulphur alone; phosphorus and sulphur; phosphorus, sulphur, and lime; and phosphorus and a high rate of sulphur. These were obtained by using superphosphate at 2 cwt, double superphosphate at 1 cwt, gypsum at 1 cwt, superphosphate at 2 cwt plus lime at 1 ton, and superphosphate at 1 cwt plus sulphur at 20 lb per acre.

All these were used with cross treatments of molybdenum and with various other materials containing manganese, copper, and/or boron.

Responses to Fertilisers

Past information on these areas indicated that there would almost certainly be superphosphate and lime responses and that the superphosphate response would show phosphorus to be important. On 14 of these trials responses to fertilisers were obtained and on one no establishment of clovers took place and therefore no responses at all were shown.

In all trials lime responses were obtained, indicating the importance of lime for initial improvement and confirming the reason for its use in past development. This feature, however, needs more careful discussion.

In all cases the soils were responsive to phosphate, but in none were good responses to phosphate obtained in the absence of sulphur. This in turn explains the good results with superphosphate in the past, but shows clearly that these were not simply phosphate responses as all past literature on the subject suggests.

Sulphur gave good responses in all trials and sulphur on its own was better than phosphorus on its own in a number of trials.

There were nine responses to molybdenum and this will be discussed at some length.

The important feature of the area as a whole is that it has this series of multiple deficiencies, that is, sulphur, phosphorus, molybdenum, and lime,

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and in 11 trials this combination was the best treatment. The next best treatment was sulphur, phosphorus, and molybdenum, which was not greatly inferior to that in which lime also was used. Phosphorus and sulphur responses were a long way behind those obtained with the inclusion of molybdenum or lime, and individual responses to sulphur were small and to phosphorus less. Molybdenum and lime increased the response to sulphur and phosphorus. This clearly shows that in no case was phosphorus on its own important. Previous references which referred solely to phosphate deficiency on these soils are therefore incorrect, as they were established on the use of superphosphate.

The result also shows that sulphur, though not greatly important on its own, is nevertheless deficient on this area on soils which have not been disturbed (cultivated) or improved with topdressing.

Lime and Molybdenum

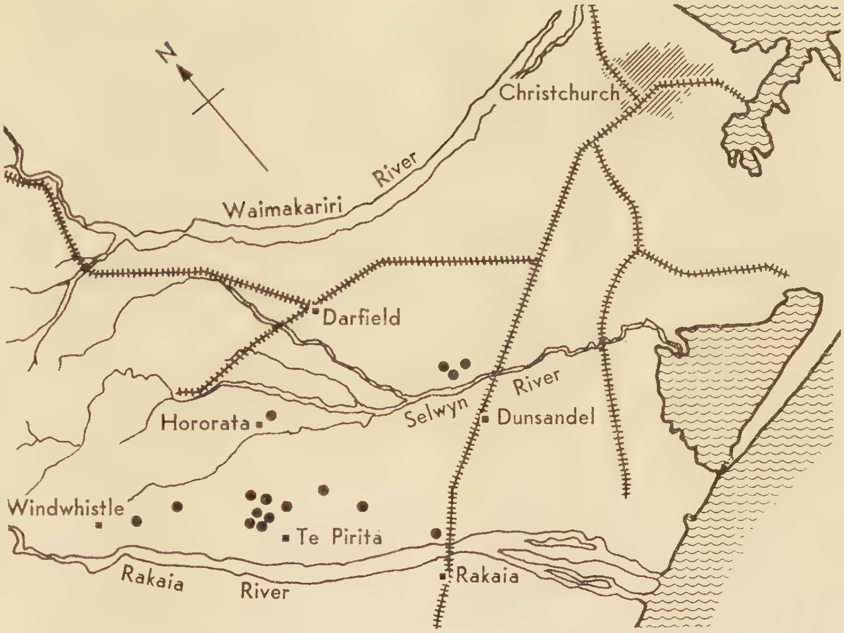
The lime and molybdenum responses also are interesting. It was not expected that molybdenum would respond on all sites, but that it did so on nine is an indication of its importance. This suggests that one reason for the good effects from lime in these areas in the past may have been due partly to a rise in soil pH and partly to the release of previously unavailable molybdenum from these soils.

As most of these soils are within the pH range of 5.1-5.4 and are of low volume weight and low in clay and organic matter, lime applications result in a fairly quick and substantial rise in pH. In this series of trials 1 ton of lime was used and this may have been insufficient to free enough molybdenum to mask the effect of an additional response when molybdenum as well as lime was used. It is felt that the heavy dressings of from 2 to 4 tons of lime which are still recommended on these soils are making enough molybdenum available for plant growth.

It is almost certain that one other effect of the 1 ton of lime application on these trials has been to increase the effectiveness of nodulation of the clovers, and this may have been its greatest advantage over the molybdenum without lime plot. Generally the initial response to lime was better than the response to molybdenum, but the two together were better than lime alone.

The salient feature of this part of the experiment was therefore the discovery that molybdenum deficiencies are widespread on the unimproved soils of this area and that one effect of lime is likely to have been its effect in making molybdenum available in these soils. This know-

FERTILISER RESPONSES ON CANTERBURY SOILS



The sites of the trials are indicated by black dots.

▼ Some very marked improvements have been made in recent years in farming the light, stony soils of the Canterbury Plains, most of which have depended on the use of lime and superphosphate. Trials as shown here are giving more information on the value of such elements as molybdenum and sulphur as well as on lime and phosphate.

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PRODUCTS RECOMMENDED:
Rosette Stage: TARTAN M.C.P.A.
After seed heads form: TARTAN 2,4-D BUTYL ESTER.
For Spot Spraying: TARTAN 2,4-D FREE ACID.

DOSAGE RATES:
M.C.P.A.: 4 pints (2 lb. acid equivalent) per acre.
2,4-D FREE ACID: 1 gallon to 200-300 gallons of water.
2,4-D BUTYL ESTER: 4 pints (2 lb. acid equivalent) per acre.

TIMES OF APPLICATION:
Early Spring: Boom spray just before Spring growth of clover begins. Little damage to clover results at this stage.
Late Spring: To catch late germinating plants and older plants surviving earlier application, spraying should be done at the susceptible stage before any stalk formation takes place.
Summer: If spraying is delayed until summer, use 2,4-D Butyl Ester. Alternatively seed heads can be mown when flowering begins and the regrowth sprayed at the rosette stage with M.C.P.A. This method is good where ragwort is at widely varying stages of growth.
Regrowth: Where ragwort has been allowed to set fertile seeds new seedlings may appear for several years. Spray at the rosette stage.
Spot Spraying: Preferable to boom spraying when patches are sufficiently isolated. The use of 2,4-D Free Acid is preferable as clover damage is no problem in spot spraying.

GENERAL DIRECTIONS:
Ragwort is sufficiently resistant to M.C.P.A. and 2, 4-D to warrant more than the minimum amount of water per acre. From 20 to 50 gallons should be used.

CAUTION:
Keep stock, especially cattle, off the sprayed Ragwort for about 14 days. The wilting stage is palatable and if they eat too much, poisoning may result.

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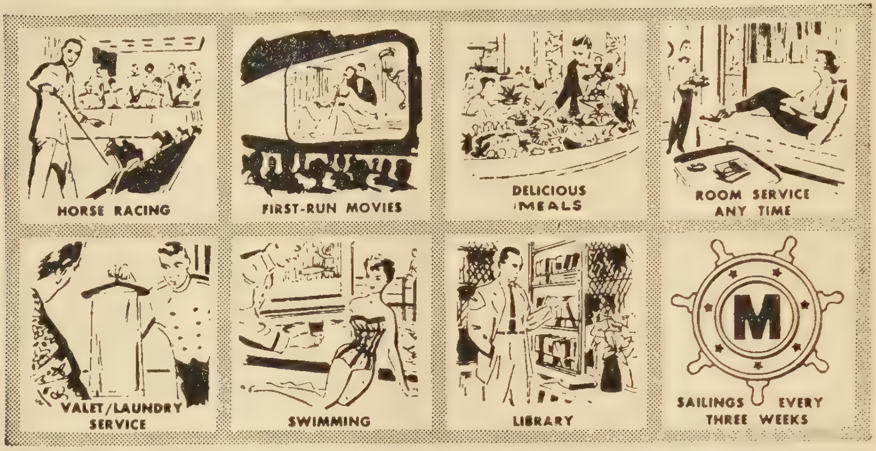

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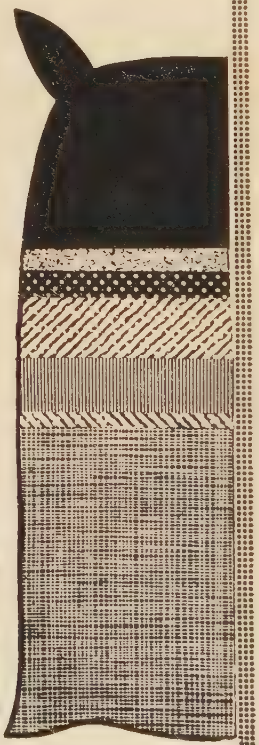
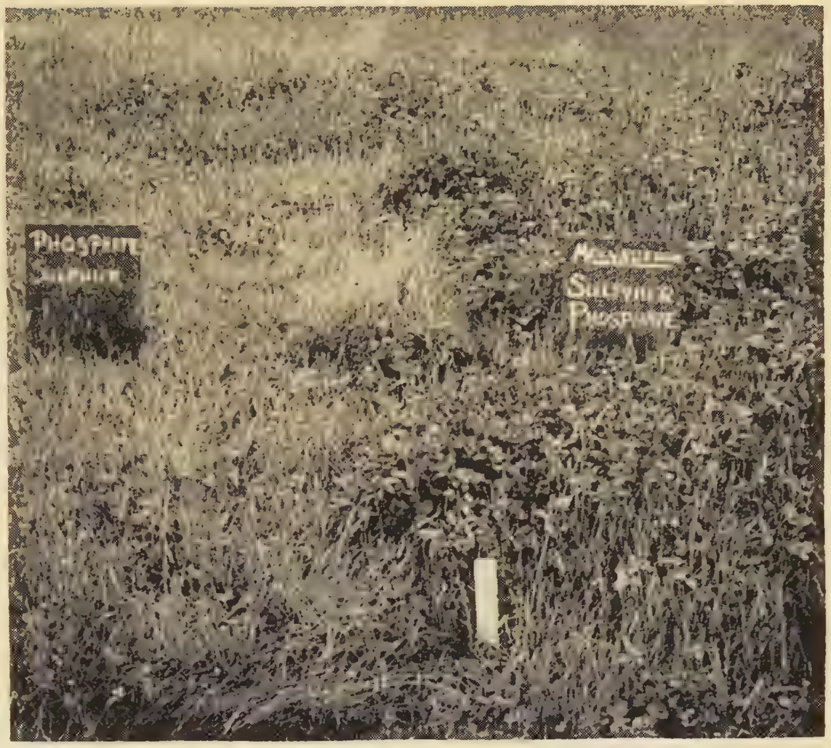


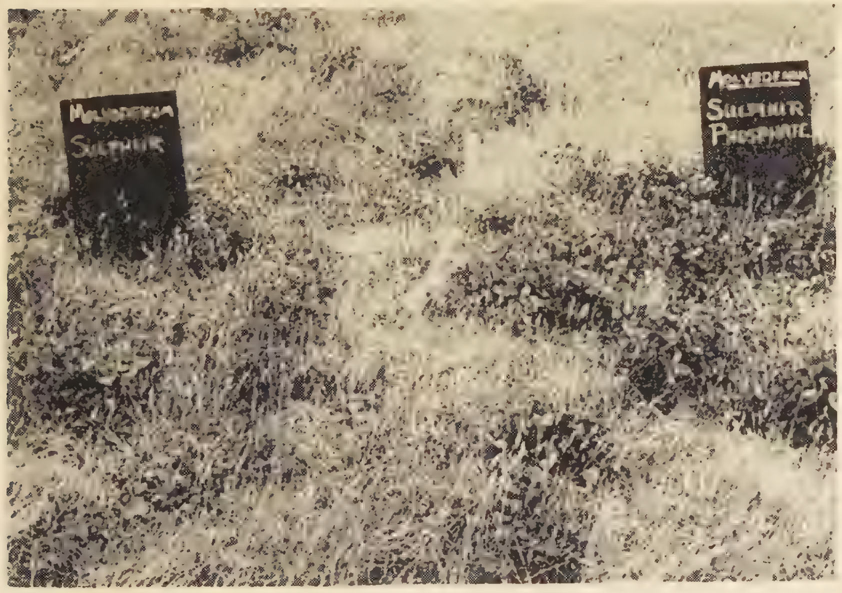
ledge can, of course, be used to economic advantage by farmers in improving these soils, as where the initial effect of molybdenum is not far short of 1 ton of lime it would be much cheaper to use a small amount of molybdenum and maybe even a low rate (5 cwt) of lime. This would be much better than using the high rates of 2 to 4 tons of lime.

Molybdenum should not be used on areas which have had previous liberal dressings of lime, as on most of these soils molybdenum uptake by pasture would no longer be a limiting factor, and could be reaching a dangerous level for stock. This statement does not apply to all soils, however, because there are soils on which heavy dressings of lime have not been effective in correcting molybdenum deficiency.

There is some evidence of copper deficiency in stock on the improved areas of the light plains soils. Some of these soils grow pastures low in copper and very low in molybdenum. During pasture improvement with lime alone, or lime and molybdenum, the molybdenum content of the pasture may be raised slightly. This is a necessary step, but it may sometimes affect adversely the copper storage in sheep or cattle grazing on improved pasture of low copper content. A high sulphate content must be present in pastures to have an adverse effect from molybdenum in the copper content of sheep. To prevent copper deficiency over-liming and the use of molybdenum on already heavily limed paddocks should be avoided, though it may not be possible to prevent copper deficiency in all cases.



Large molybdenum responses can be obtained on these plains soils where little or no lime has been used. The plot at left shows that clover growth is still being limited by molybdenum deficiency when phosphate and sulphur have been used, but the plot at right shows profuse growth with the addition of molybdenum.



Trials confirm that these soils are deficient in phosphate, as has been frequently established in the past. Molybdenum and sulphur in the plot at left are not very effective in the absence of phosphate.

Soils Deficient in Sulphur

The next important feature of the trials is the indication of widespread sulphur deficiencies inherent in these soils. This information may appear of little importance, as by far the majority of these soils are initially so very low in phosphate that superphosphate may always be recommended for their improvement. There are, however, some important implications of this which will require further study. A very large number of sulphur trials on the improved pastures on these soils had failed to reveal any sign of sulphur deficiency, and possible explanations of this are that residual effects of the sulphur supplied by superphosphate may still be effective, that cultivation and good pasture management are continuing an adequate turn-round of organic sulphur, and that on the less improved areas phosphate may not have been built up to a stage where it has ceased to limit production.

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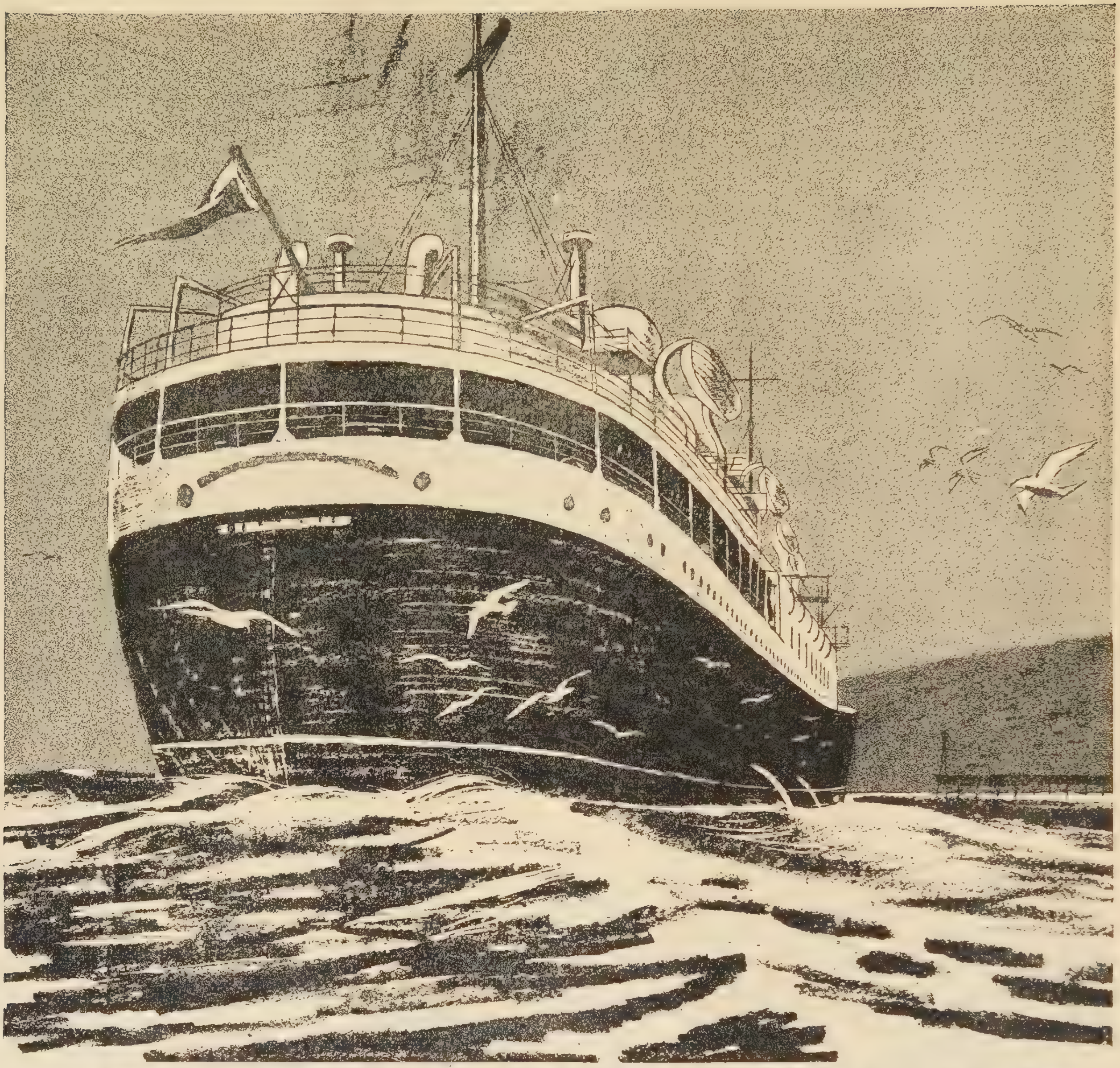

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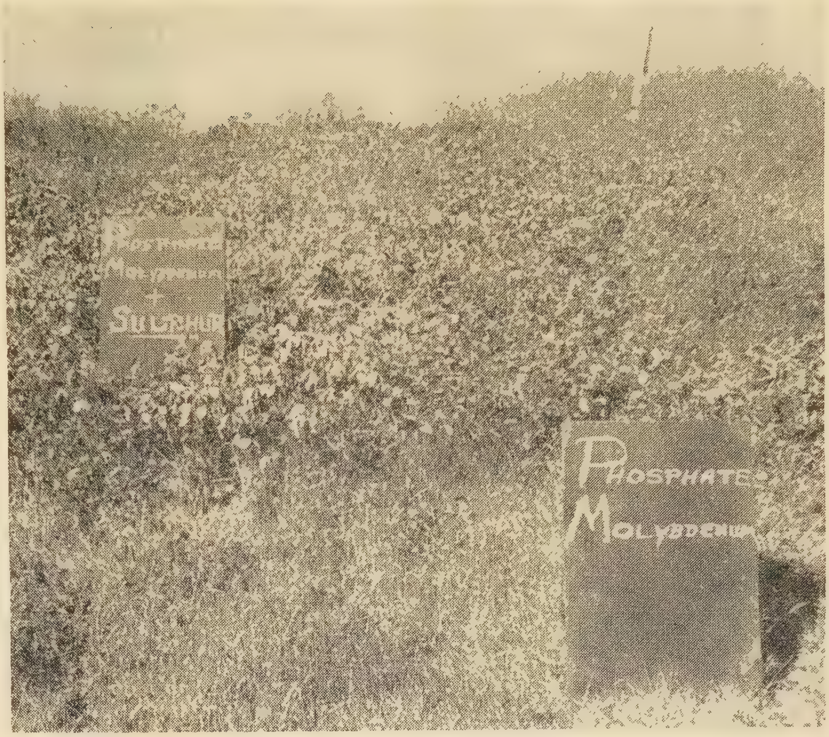


Whereas the lower illustration on page 323 shows the importance of phosphate, the one above shows the importance of sulphur. The response from phosphate and molybdenum in the foreground is negligible.

In the series of trials discussed, however, the effects of previous treatments were kept to a minimum and each limiting factor was studied alone and in combination with other factors. As a result it was found that though phosphate was a limiting factor, so also was sulphur. In conjunction with results from this series of trials results on similar soils in North Canterbury, Mid Canterbury, South Canterbury, and Marlborough show that this situation, though not universal on these soils, is quite common to them.

In any further discussions on the fertility of these soils it will be necessary therefore to consider the effects of sulphur deficiencies on them. In many respects this is important, as it could influence such factors as the cost of improving and maintaining fertility, and ultimately may mean considerable alteration in the fertilisers to be used on them.

It should be realised that a large area of these soils has been brought to high production over a period of years. On them phosphate has been steadily built up by the use of superphosphate, and as these soils do not readily fix phosphate in a form unavailable to the plant, there is likely to be a reserve of unused phosphate on many of them. Evidence to this effect, though as yet scanty, is coming to hand and a trial in Mid Canterbury is showing that on highly improved areas most of the effect of topdressing with superphosphate is now coming from sulphur.

The fact that superphosphate responses are now not readily seen on these highly improved areas may also indicate that some lessening in the amount and frequency of the fertiliser may be economic. Depletion of the sulphur (especially when supplied as gypsum in superphosphate), by leaching, however, seems fairly rapid, so that sulphur deficiencies would soon recur. Provided previous phosphate additions have been high, it might then be possible to maintain the gained fertility in these improved areas by the addition of sulphur only. This appears to be the case in the trial quoted and also in a number of other trials where it has taken from two to three years before sulphur responses have shown up.

The evidence then that these soils are deficient in sulphur may be of considerable value in the final determination of the fertiliser practice to be applied to them.

Other Minor Elements

Included in this series were plots with manganese, copper, and boron. Though it is considered that these elements were of economic significance, the part played by boron on these areas may require further investigation. On a number of trials boron appeared to give a response in clover growth, especially on the limed strip. This seems to accord with the theory of lower availability of boron with decreasing soil acidity brought about by the use of lime.

It is not intended that the information from these trials be considered as a complete picture of the fertility problems of the Canterbury plains soils, nor that practices for their improvement should be changed. The aim was to find out what possible part molybdenum and sulphur may have played in contributing to the already proven value of lime and superphosphate on these areas. The trials establish that both have been important factors and suggest that part at least of the benefits of lime has been due to molybdenum release and part of the value of superphosphate has been due to the sulphur it has supplied. These are important findings, as there are several ways by which this knowledge can assist the farming of both the undeveloped and the improved areas of these soils.

Farm Advisory Division New Name of Extension Division

READERS will have noticed reference in the "Journal" to the Farm Advisory Division of the Department of Agriculture. This is the new name of the former Extension Division, which was formed in 1948 as the result of an amalgamation between the Fields Division and the Rural Development Division.

With the change of name there has been a corresponding change in the designations of certain professional officers in the Farm Advisory Division and also in the Horticulture and Animal Industry Divisions.

Care of Livestock during November

Contributed by the Animal Research Division

DRY EWES

If dry ewes have not already been removed from the flock, they should be separated immediately. It is a good plan to shear them, and during shearing they should be inspected carefully for udder abnormalities. All ewes whose udders were empty at lambing and ewes with diseased udders, damaged teats, very large teats, very small teats, or badly placed teats should be culled. Dry ewes with defective mouths and old ewes which did not have a lamb this year should also be culled.

Dry ewes which are retained should not be allowed to get too fat during summer. If kept in hard store condition, they are more likely to hold when mated next autumn.

CONTROL OF FAT LAMB PASTURE

Pastures on which ewes and lambs are grazing should never be allowed to become rank. If pastures are getting too long, they can best be controlled by cattle. Yearling beef cattle soon become quiet and they can then be run with ewes and lambs even in small paddocks.

SHEARING PREPARATIONS

Preparations for shearing should be made now. Attend to sheepyards and scrub out the woolshed. This will reduce trouble from such diseases as blood poisoning, tetanus, and caseous lymphadenitis (lympho) after shearing. Check over all machinery to see all parts are in good working order. Dag all dirty sheep and shear hoggets, wethers, dry ewes, and rams. When culling sheep before shearing pay particular attention to teeth, udder, and dropped belly. On fat lamb farms ewes are best shorn after one or two drafts of lambs are away.

Where lambs are weaned early this can be done at shearing time late this month. If lambs were not vaccinated against scabby mouth at docking, this can be done at shearing and weaning.

EWE MANAGEMENT

Where special paddocks have not been reserved for early-weaned lambs and when feed is scarce a worth-while result may be achieved by removing the ewes and leaving the lambs in the paddocks. When feed is scarce this removal of ewe competition for the feed more than offsets the loss of the small supplement of milk.

On hill country early-weaned ewes can be mob-grazed to assist in control of bracken.

VACCINATION AGAINST CONTAGIOUS ABORTION

Vaccination has reduced the New Zealand average rate of abortion in dairy cows from about 5 to 1 per cent. There are, however, still too many dairy farmers who do not vaccinate their calves. Past freedom from abortion is no excuse for not vaccinating, as infection may be introduced into a herd at any time.

Though vaccination does not begin until January or February, applications should be made now, as veterinarians and inspectors of stock have to plan their vaccination itineraries. Late applications make this planning difficult. Calves should not be vaccinated until they are over four months. Poor immunity results if they are vaccinated before this.

HYDATID CONTROL—The safe disposal of sheep offal for control of hydatid infection is especially important during shearing time. At this time of the year there are extra dogs which require extra feeding, and the aged sheep used for this purpose are most likely to harbour cysts. During this busy period extra vigilance is necessary to see that offal is dealt with safely.

Beef cows are just as susceptible to contagious abortion as dairy cows. By vaccinating heifers before mating many farmers have been able to increase the calving percentage of their beef cows very considerably.

GRAZING MANAGEMENT OF DAIRY PASTURES

During the season of maximum grass growth the problem is to control pastures at their most leafy, nutritious stage. This is best achieved by conserving as silage and hay all growth surplus to requirements. Later on in the season it is important to maintain sufficient pasture cover to ensure growth during the dry summer period. As grass growth declines the periods for which paddocks are spelled between grazings should be gradually increased and as much silage as the cows will clean up should be fed out.

DIP RAMS EARLY

Rams should be dipped before they begin to flush, preferably before Christmas; flushed rams sometimes scald after dipping.

CARE OF PIGS

Dry sows should have access to good pasture and in addition should receive from 2 to 4 gallons of milk per day, depending on their condition. They should be kept thriving but should not be allowed to become too fat. Keep only as many of the spring litters for baconers as can be fed adequately, and sell the remainder as porkers.

Pasture and Crop Production

Seasonal Notes by the Farm Advisory Division

CONTROL OF TWIN CRESS IN DAIRY PASTURES

TWIN cress or land cress is not a troublesome weed in dense, well managed pastures where a good cover can be maintained, but there are always bare patches round gateways and trees where it can thrive. A cow eating 1½ oz of this plant secretes cress-tainted milk for several hours after, so that the need for control is plain.

Pastures should be examined now for twin cress, particularly round gateways and trees. A fine day should be selected to control it and infested parts sprayed with MCPA at ¾ to 1 lb acid equivalent (1½ to 2 pints) per acre. The cows should then be kept away for a few days to give the twin cress time to die off.

Cress taint is difficult to detect in the cream when cold, but becomes very marked as soon as heat is applied. One unsuspected can of cress-tainted cream mixed into a vat can downgrade 6 tons of butter during manufacture.

—M. G. BOYER, Te Awamutu

* * *

ALTERNATIVE WINTER FEEDS

WHERE pasture alone is used for wintering stock inclusion of 5 to 6 oz of turnips or swedes in the mixture when sowing new grass adds to the bulk of the pasture.

On the lighter soils and mainly as a winter feed for sheep a bushel of blue lupins may be included in the grass mixture. A low seeding of lupins may be included with other forage crops or sown alone as a winter feed crop at 2 to 3 bushels per acre. A common practice is to sow a mixture of ryegrass, lupins, and turnips, and sometimes a few ounces of chou moellier is added. When sown as a mixed winter feed either Italian or short-rotation ryegrass is used, but the mixture is used on occasions even when sowing down with perennial ryegrass as a permanent pasture.

On the heavier soils and under high rainfall a crop of swedes provides the main winter feed. Where loss from cauliflower mosaic occurs the resistant varieties Calder or Sensation should be sown. On the lighter, drier soils turnips replace swedes. With both turnips and swedes the inclusion of ½ to 1 bushel of lupins sown with the root seed or in alternate drills adds to the bulk of leafy material produced. Chou moellier is also grown with roots and 3 to 4 oz with 10 to 12 oz of swede or turnip seed is sown. Alternatively, where chou moellier is the main crop 4 to 5 oz of swede or turnip seed is sown with 1¼ to 1½ lb of chou moellier. When this mixture is sown the turnips or swedes are sown separately through two or three coulters of the drill.

On dairy farms, especially for town milk supply, chou moellier is the main source of forage. The area of chou moellier is often supplemented with an area of mangels and in addition or as an alternative to the mangels an area of fodder beet is often grown. Fodder beet is not such a heavy cropper as mangels, but is higher in dry matter and food value and is an easier crop to handle.

—R. G. JOLLY, Christchurch

* * *

LUCERNE SOWING

LUCERNE requires a firm, fine seedbed in which lime is adequate. Times for sowing vary with conditions, but in Canterbury early spring is usually favoured, with late September to early October the most popular period. Early sowing ensures that the seed is placed in a sufficiently moist soil for satisfactory germination and allows a full growing season for establishment. Annual weeds such as fathen can later be controlled by mowing. Though autumn sowing after a summer fallow is still common, results are not generally as satisfactory, for moisture is frequently a limiting factor and after a dry summer weeds such as chickweed may be troublesome after autumn rains.

Nodule forming bacteria are necessary for the successful establishment of lucerne and these should be supplied by the inoculation of seed before sowing.

In Canterbury drilling is the most satisfactory method of sowing and the usual practice is to mix the culture-treated seed with a 50-50 mixture of lime and superphosphate which has been given time to revert and to sow in 3½ or 7 in. drills. Cross drilling is occasionally carried out, but broadcasting is not recommended.

Rates of seeding vary, but 8 to 10 lb of culture-treated seed per acre is sufficient and a heavier rate will most certainly not compensate for poor seedbed preparation. Much has been written on the importance of shallow drilling, but the ideal depth is 1 in. With shallower sowings, sufficient moisture for rapid germination may not be available and exposure to sunshine or air will kill the bacteria supplied to the culture. Light harrows should follow the drill, but rolling after drilling is not recommended.

—E. G. SMITH, Rangiora

* * *

SAVING FEED FOR LAMB WEANING

LATELY, after research work at Ruakura, many farmers in the North Island have turned to early weaning of lambs as a means of better use of feed supplies and better pasture management.

From farmers' reports it seems that the time of weaning does not have a great effect on lamb weights as such, provided they are weaned on to good spelled pasture. Most of the notable variations occur in times of shortage of pasture for ewes and lambs followed by poor feed at weaning.

Pasture for weaned lambs should be clover dominant, leafy, and about 4 in. long. On fat lamb farms the aftermath of hay or seed crops is ideal for early and late weaning. On hill-country farms it is essential that suitable areas are closed from stock in time to give the desired pasture conditions when needed for weaning and to ensure that not less than three weeks elapses to obtain the maximum depletion of the worm population.

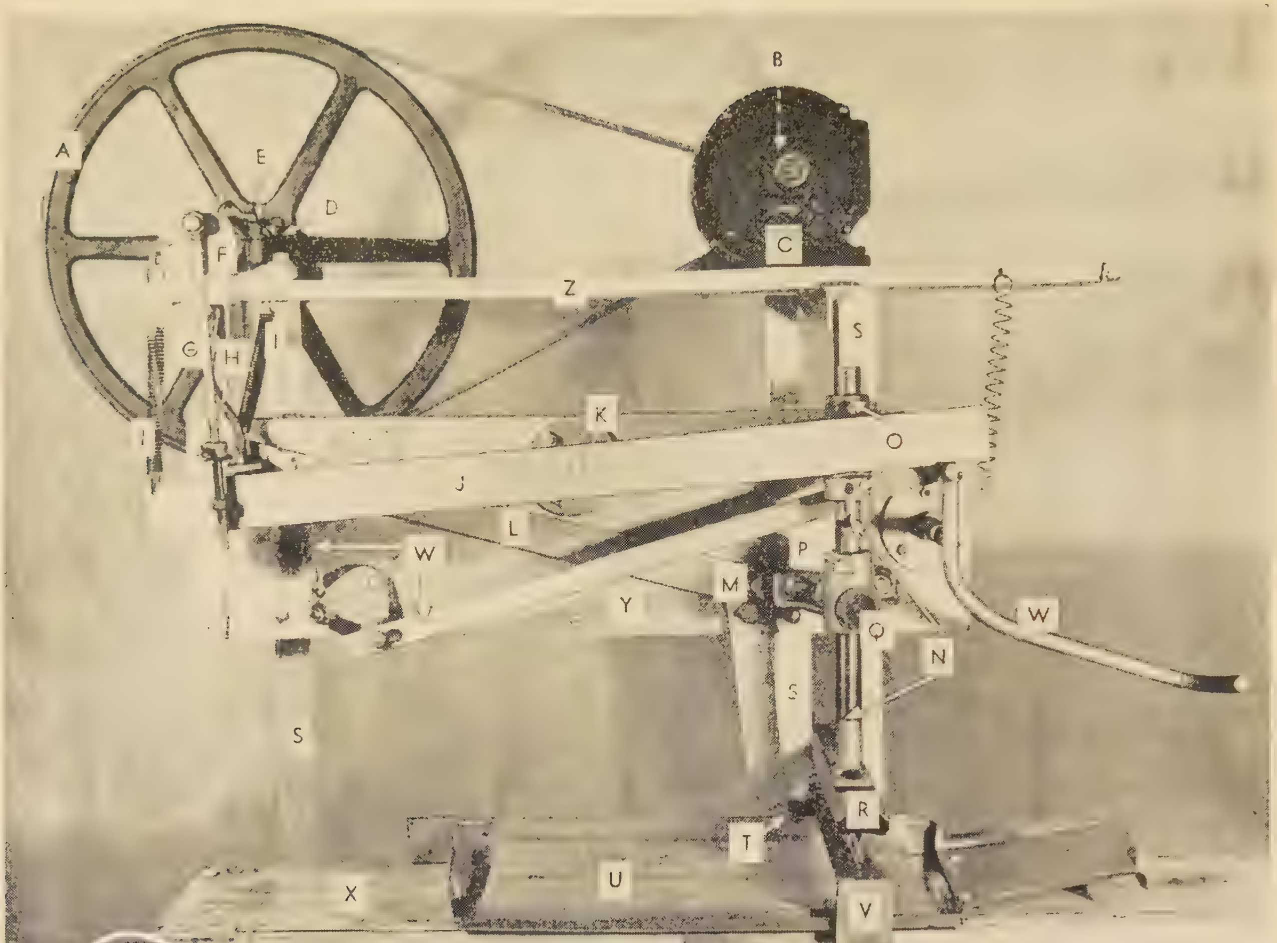
The warmest paddocks with the greatest clover content should be chosen for weaning and any unexpectedly fast growth controlled by cattle, not sheep.

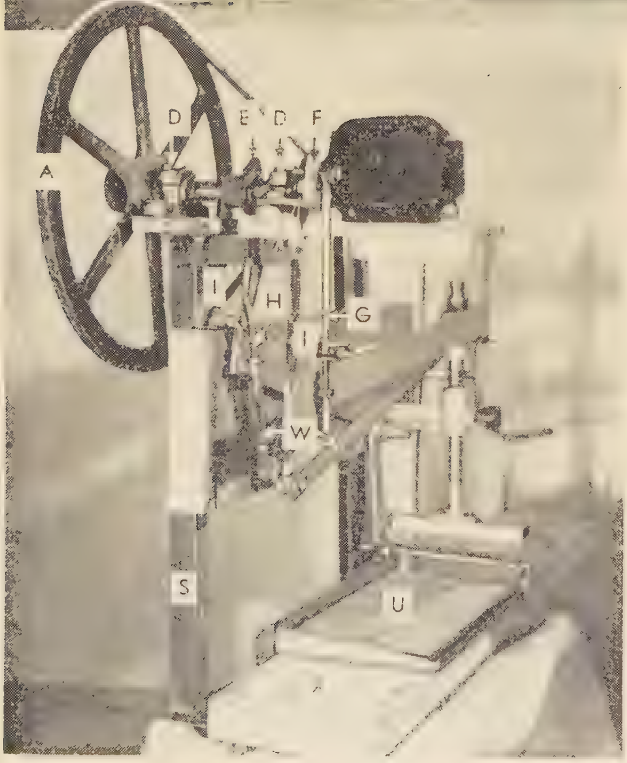
In areas subject to summer drought the maximum growth period ends toward the end of November and the pick of the pastures should be close grazed and then closed from stock at the beginning of the month to ensure the production of a mature clover dominant sward fit for early weaning. Late weaning under these conditions, especially where subterranean clover is the chief sward legume, usually makes for a dry and stemmy pasture and poor lambs.

High-quality pastures are essential for maximum lamb growth. Quality for weaning means not only good clover content but short, mature growth, and to achieve this in fast-growing seasons weaning must be delayed until lambs and cattle are likely to gain good control.

Particularly in summer drought areas it is a good insurance, where possible, to sow an area of kale or turnips for weaning if pasture spelling has not been possible owing to shortage of feed. If the crop is not required for weaning, it can be carried as a run-off in case conditions favouring facial eczema outbreaks occur.

—H. DE O. CHAMBERLAIN, Gisborne





Parts of the Mechanical Pricker Pad

A—18 in. V pulley
B—2 in. V pulley (obscured by motor)
C—$\frac{1}{4}$ h.p. motor
D—Drive shaft and plummer blocks
E—Cam
F—Eccentric
G—Rod operating pivoted arm to pricker shaft
H—Rod operating pivoted arm to comb tray
I—Tension springs for G and H
J—Pivoted arm to pricker shaft
K—Pivot point for J
L—Pivoted arm to comb tray
M—Pivot point for L
N—Vertical shaft of pricker head
O—Flanges with grub screws
P—Sleeve bearing and bracket
Q—Grease cup for sleeve bearing
R—Pricker head
S—$1\frac{1}{2}$ in. x $\frac{1}{8}$ in. angle iron framework
T—Spring-loaded pawl
U—Comb tray
V—Guide plate
W—Clutch lever and mechanism
X—9 in. x 2 in. base board
Y—9 in. x 2 in. back board
Z—9 in. x $\frac{7}{8}$ in. top mounting board

Mechanical Pricker for Extracting Heavy-bodied Honey

BY the development of the hand pricker pad and the installation of comb warming rooms clean extraction of heavy-bodied honeys from the comb has become commercially payable and the production of such honey is economically practical, though the work is still laborious, unpleasant, and time consuming and the wear and tear on combs is excessive. In this article D. Roberts, Apiary Instructor, Department of Agriculture, Auckland, describes a mechanically operated pricker designed and built by Mr B. G. Sharp, of Matakana, which has so improved the extraction of heavy-bodied honey that the labour requirement and the damage to combs are very little more than that involved in the extraction of light-bodied pasture-type honeys. An article in next month's issue will explain how a simply made press can be used to separate heavy-bodied honeys from wax cappings and unmarketable comb.

HEAVY-BODIED honey, particularly that gathered from manuka, is almost impossible to extract from the comb without means of breaking the adhesion of the jelly-like portion of the honey to the cell walls or by passing the combs through a press. In the early days of beekeeping in New Zealand the use of the press to extract these honeys was universal.

The use of the press has many disadvantages, the act of pressing tending to incorporate fragments of wax, propolis, and other residues in the honey. With heavy-bodied honey it is impossible to remove these residues completely by straining unless the honey is heated to a point where its flavour and aroma are adversely affected. In addition pressing destroys the combs, which must then be rebuilt by the bees from foundation every time a crop is taken.

Though the hand pricker pad has enabled much greater advantage to be taken of nectar sources yielding heavy-bodied honey, its use tends to shorten greatly the effective life of combs and promotes the building of drone comb. In addition release of honey from the comb is never as clean as could be desired, up to 20 per cent or more of the honey being retained after passage through the extractor. Much of this is lost to the beekeeper when combs are returned to bees for drying out.

The mechanical pricker designed and built by Mr Sharp overcomes most of the disadvantages associated with the use of hand operated types and enables heavy-bodied honeys to be extracted cleanly with the minimum of wear and tear to the combs and with very little more effort than that needed for the extraction of light-bodied, free-flowing honeys.

Action of Machine

The machine is relatively simple and requires very little power for operation, a ¼ h.p. electric motor providing more than sufficient torque. The capacity of the machine in terms of combs per hour as it is used by Mr Sharp is 63. If a greater capacity is desired, the output of the machine can be raised by increasing shaft speed or doubling the size of the pricker head.

The action of the machine is controlled by a hand clutch lever. The combs of honey are first uncapped and then placed in a metal comb tray at the base of the machine. Engagement of the clutch lever causes the comb tray to move along the base of the machine in movements of 3/16 in. at a time. As the tray moves along it passes underneath a guide plate through which the points of the pricker operate. Movement of the pricker head is synchronised with that of the tray so that each vertical row of cells in the comb is pricked as the tray passes underneath the guide plate. When the comb tray has passed completely under the guide plate its forward action ceases. The clutch lever is then disengaged, the comb tray pushed back by hand to its original position, and the comb removed and placed in the draining rack or extractor.

Material Needed

Timber:
  7 ft of 9 in. x 2 in. dressed on four sides
  3 ft of 9 in. x ⅞ in. dressed on four sides
10 ft of 1½ in. x ⅛ in. angle iron
26½ in. of 1 in. round steel shafting
Bearings:
  2 plummer blocks, 1 in.
  1 sleeve bearing, 1 to 3 in. long
1 electric motor, ¼ h.p.
1 2-in.-diameter V pulley, A-section belt
1 18-in.-diameter V pulley, A-section belt
1 V belt, A section
1 cam, ½ in. lift, to be cut from ¼ in. steel plate
1 eccentric, 1¾ in. overall rise and fall, to be cut from ¼ in. steel plate
Flat steel strip for operating arms, etc.
Steel rod, ⅝ in.
23 in. x 12 in. panel steel, 20 gauge, one piece
3 flanges (for supporting pivoted and clutch levers), ½ in. water pipe
1 bracket (for sleeve bearing)
Bicycle spokes, tension springs, nuts, bolts, grub screws

Simple and effortless in operation, the machine does not require the whole-time attention of the operator, who is thus left free to manage other nearby equipment such as extractors and strainers.

Construction

The machine is mounted on a 1½ in. x ⅛ in. angle iron framework 26 in. high. Attached to the framework is a baseboard of 9 in. x 2 in. timber dressed on four sides and 4 ft 3 in. long, a back board also of 9 in. x 2 in. timber 2 ft 7 in. long, and a top mounting board 3 ft x 9 in. x ⅞ in. The mounting board forms the support for the electric motor and driving shaft.

The shaft is driven by V belt from the electric motor, driving and driven pulleys being 2 in. and 18 in. in diameter respectively. With a motor speed of 1,425 r.p.m. this ratio gives a shaft speed of approximately 140 r.p.m. The driving shaft is made of a piece of 1 in. diameter shaft steel 11½ in. long. It is supported by two plummer blocks set 6 in. apart.

Mounted on the shaft between the plummer blocks is a cam made from a piece of ¼ in. steel plate. The cam is designed to give a rise of ½ in. Fixed to the outer end of the driving shaft is an eccentric arm to which is pivoted a ⅜ in. steel rod. The eccentric imparts an overall rise and fall motion to the rod of 1¾ in. The cam, by means of a spring-loaded push rod and pivoted lever, controls the forward motion of the comb tray. The eccentric, through the pivoted rod and a further pivoted lever, imparts a positive lifting motion of the pricker head.

Downward motion of the pricker head is enforced by springs in tension attached to the operating lever. The use of limited spring tension to power the downward thrust of the pricker ensures that the spikes will not be damaged or bent in the event of badly warped or broken frames being fed into the machine.

Pricker Unit

The pricker unit is mounted on the lower end of a 1 in. vertical shaft 15 in. long which slides in a 3 in. sleeve bearing held in place by a bracket 4⅞ in. long attached to the back plate.

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The shaft is thus positioned vertically midway across the width of the base board.

The sleeve bearing is placed at the working centre of the shaft. Above the sleeve bearing two collars 2 in. apart are attached to the shaft by grub screws. A fork welded to the end of the pivoted lever fits loosely in between the collars and extends 5 in. beyond. This fork imparts a vertical motion to the shaft when the lever is depressed by the pivoted rod.

Comb Tray

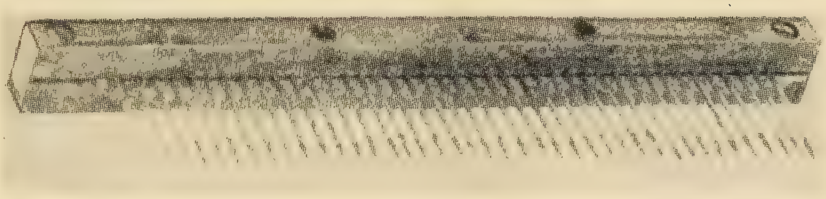
The comb tray is made of 20-gauge panel steel. Dimensions are: Length 19¼ in.; width 9⅜ in.; depth, one side, 1½ in., other side, ½ in. Riveted to the deep side is a piece of flat steel 2½ in. wide x ⅛ in. thick and 20 in. long. This steel is positioned to project ¼ in. above the upper and ¾ in. below the lower edges of the tray. The upper projecting edge is provided with serrations 3/32 in. deep, 3/32 in. wide, and 3/16 in. apart. A spring-loaded pawl attached to the lower end of the pivoted arm driven by the cam fits into the serrations and imparts the forward motion to the tray.

The forward motion of the tray is guided by the lower projecting edge of the 20 in. piece of steel, which is a sliding fit in a piece of steel channelling attached to the inner edge of the base board. This is to prevent any sideways movement of the tray in action. The guide plate, through which the spikes of the pricker head pass, also serves to control any tendency of the comb to lift upward when the spikes are withdrawn. To relieve the base of the tray from bearing too heavily on the wooden surface of the base board a metal strip 1 in. wide and 1/16 in. thick is screwed to the surface of the base board 2 in. in from the outer edge to form a runner on which the tray rests.

Pricker Head

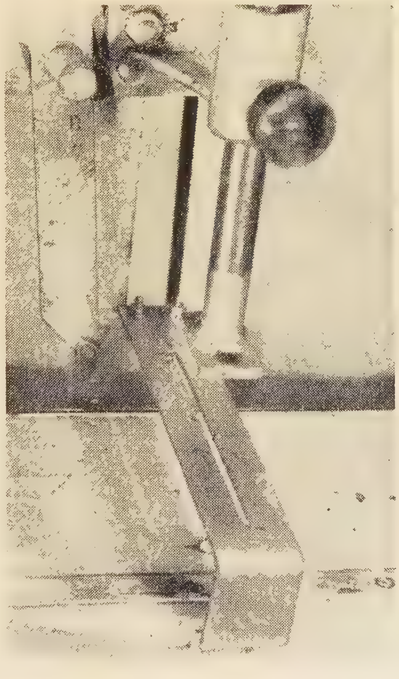
The pricker head is 9 in. long and is fitted with one row of spikes made from 14-gauge cadmium-plated steel bicycle spokes. To construct the pricker head two pieces of 7/16 in. square key steel 9 in. long are placed side by side and held together by countersunk set screws, one at each end. A series of holes of sufficient diameter to take the spokes as a neat fit are then drilled 3/16 in. apart along the adjoining faces. The set screws are removed and the adjoining faces lightly ground down until the clamping together of the two pieces with the set screws will hold the spokes completely rigid.

The spokes are cut to form spikes 1⅞ in. long, each spike being ground to a finely tapered point on the working end. Two 9 in. pieces of ½ in. square key steel are then welded to a piece of sheet steel 9 in. long x 1⅞ in. wide x ⅛ in. to provide a channel 9 in. long x ⅞ in. wide x ½ in. deep. The assembly containing the spikes should then be a neat fit in this channel. In use the assembly is held firmly in the channel by five 5/16 in. grub screws working in threaded holes drilled through the side of the ½ in. square steel.



The row of spikes in the pricker head is held between two pieces of 7/16 in. square key steel held together by two countersunk set screws.

The complete pricker head is attached to the vertical shaft by two 5/16 in. steel bolts 1 in. long. These bolts are threaded through a flange 3 in. long x 1½ in. wide x ¼ in. thick welded to the lower end of the vertical pricker shaft and are then screwed into holes tapped into the pricker head. To prevent rotation of the pricker shaft in the sleeve bearing, a piece of metal can be bolted to the pricker head and extended to fit loosely between the two angle iron uprights of the frame, or alternatively a keyway can be milled in the portion of the shaft which slides in the sleeve bearing and positive location made with a grub screw.



The arrangement of the vertical shaft of the pricker head and guide plate.

Clutch Lever

The clutch lever is used to place the pricker head and comb tray mechanism out of gear while combs are loaded and unloaded from the tray. The clutch mechanism is mounted at one end of the back board. It consists of a pivoted lever to which is attached a flat steel strip loosely fixed at its opposite end to a further pivoted piece which is connected by a short piece of bicycle chain to the push rod driven by the cam. At the point of attachment to the flat steel strip the clutch lever is extended at right angles so that the extension lies under the projecting portion of the fork which operates the pricker head. Pulling the clutch lever downward lifts the pricker head to its highest position and at the same time pulls the push rod of the tray operating mechanism out of contact with the cam, thus holding the machine out of gear. The accompanying photographs show the general construction of the machine.

Advantages of Machine

Because the spikes of the pricker are thrust completely through the midrib of the comb at each movement it is necessary to prick the comb only from one side. The spikes of the pricker pass through the centre of the cell bases and do not break down or damage the cell walls. The puncturing of the cell bases has no apparent weakening effect on the combs and the punctures are quickly repaired by the bees when the combs are returned to the hives. The use of only one row of spikes enables even the toughest of old brood combs to be easily pricked without damage.

Because this pricker does not damage the cell walls or distort the comb in any way there is very little tendency for the bees to rebuild the combs as drone comb. Breaking of the frame wires, so common with multiple-point hand-operated prickers, is almost completely eliminated. This pricker secures a much quicker, cleaner, and more even release of honey in the extractor and consequently obviates a great deal of the stress to combs usually associated with the extraction of heavy-bodied honeys.

Photos by Cameron.

Swede and Turnip Varieties

A COMPREHENSIVE range of 17 varieties of Government approved seed of both turnips and swedes is available to meet the varying conditions throughout New Zealand.

Swedes

SEVEN varieties of swedes include **Superlative**, **Grandmaster**, and **Crimson King** as general-purpose types.

Wilhelmsburger is a late-maturing swede which is moderately resistant to disease and aphid attack.

Wye, a white-fleshed swede, is highly resistant to clubroot, and as the seed of this variety is small, it should be sown through the turnip side of the seeders fitted to the ridger.

Calder and **Sensation** (yellow fleshed) are intended for the drier districts, as they are more resistant to aphid and mosaic attack. They are deeper rooting and tankard shaped and for this reason yield perhaps even less than other varieties when the plants are unduly crowded in the row.

Yellow-fleshed Turnips

Of the six varieties in this group four are regarded as harder fleshed and are most suitable for the colder and wetter regions. These are **Green Top Yellow** and **Purple Top Yellow**, while **Green Resistant** and **Purple Resistant** are clubroot resistant strains recommended where a second crop in succession is required.

Waite's Eclipse is a semi-tankard type very suitable for rolling country.

Champion Hybrid has a still softer flesh and is a very suitable variety for the poorer soils in the colder regions. It is preferred for early grazing by young sheep before going on to swedes or turnips, having harder flesh.

White-fleshed Turnips

The four varieties of white-fleshed turnips are least demanding in environment and can be grown successfully over a wide range of conditions. **Green Globe**, **Red Globe**, and **Purple Globe** are general-purpose types, the first named being perhaps most suitable for winter grazing.

York Globe has the capacity, when sown late, to develop rapidly with autumn rains, and will also keep remarkably well into winter. Because of its sparser top it seems the best variety for sowing with pasture.

Government-approved Seed

As is the usual practice stocks of each variety of Government-approved turnip and swede seed will in 1959 be blended before distribution throughout New Zealand. In this way seed of a particular variety will be of a uniform quality irrespective of the district in which it is sold to the farmer. Government-approved seed is packeted in appropriately labelled 1 and 2 lb calico bags, sewn with a lockstitching machine and carrying a Departmental over-stamp.

Seed of all except one of the varieties of Government-approved turnip and swede seed being distributed to retailers this year has a germination of over 90 per cent. Seed of one variety, Waite's Eclipse, though below that standard, has a germination of 85 per cent. If seed of any variety from an earlier distribution is still available from retailers, samples should be subjected to a fresh germination test before sale.

—J. O. WALLACE, Dunedin

New Senior Position in Horticulture Division in South Island

MR J. H. WATT, Horticultural Extension Officer in the Horticulture Division of the Department of Agriculture at Wellington, has been appointed Horticultural Extension Officer at Christchurch.

Mr Watt.

The position is new in Christchurch. The Division is endeavouring to broaden its district experimental and advisory services and this will be Mr Watt's particular field in the South Island.

Mr Watt joined the Department at Christchurch as a temporary Fruit Inspector in 1939. In 1945 he became Orchard Instructor at Alexandra. The following year he transferred to Dunedin and again in 1948 to Wellington.

In 1947-48 Mr Watt accompanied Dr C. H. Cadman of the British Research Council on a small fruits survey in New Zealand.

In 1949 Mr Watt completed a B.A. degree. In 1950 he was promoted to Horticultural Economist and that year was awarded a Commonwealth Fund Fellowship to study at Cornell University, from which he gained an M.Sc. degree in 1952.

Dairy Produce Graded for Export

THE following figures showing quantities of dairy produce graded for export during June 1959 and for the 11 months ended 30 June 1959 with comparative figures for the same month and for the 11 months of 1957-58 have been compiled by the Dairy Division of the Department of Agriculture from figures supplied by divisional officers at the various grading ports:

BUTTER

Period	Creamery (tons)	Whey (tons)	Total (tons)	Percentage inc. or dec.
June 1959	907	14	921	—
June 1958	388	10	398	—
Increase or decrease	+519	+4	+523	+131.407
11 months ended 30/6/59	175,592	2,714	178,306	—
11 months ended 30/6/58	171,260	2,866	174,126	—
Increase or decrease	+4,332	—152	+4,180	+2.401

Butter in store at 30 June 1959 was 14,190 tons

CHEESE

Period	White (tons)	Coloured (tons)	Total (tons)	Percentage inc. or dec.
June 1959	812	—	812	—
June 1958	1,067	1	1,068	—
Increase or decrease	—255	—1	—256	—23.970
11 months ended 30/6/59	66,423	13,429	79,852	—
11 months ended 30/6/58	77,697	13,251	90,948	—
Increase or decrease	—11,274	+178	—11,096	—12.200

Cheese in store at 30 June 1959 was 12,376 tons

If these figures are converted into butterfat equivalent, there is a decrease of 0.381 per cent in butterfat graded for the 11 months as compared with the preceding season. The above figures refer only to butter and cheese graded for export, and owing to diversions which may take place they are not necessarily a true indication of production trends.

World Cattle Numbers in 1958

INDICATIONS of possible effects in the level and direction of world trade in beef were contained in a survey of recent movements in cattle numbers in many parts of the world in the April issue of the United States Department of Agriculture's "Foreign Crops and Markets". A summary of this information follows.

IN 1959, for the first time in history, the number of cattle in the world is expected to exceed 1,000 million.

During 1958 numbers increased steadily, the total (992 million) being 1 per cent (14 million) above the 1957 figures and 8 per cent (77 million) above the 1951-55 average. The pre-war figure (1938-39) was approximately 700 million. Numbers were seriously depleted in many countries during the war and the increase over the last ten years has been substantial.

The expansion of approximately 14 million in 1958 was made up of a 4.1 million increase in both the U.S.S.R. and North America, 2.2 million in South America, 1.9 million in Europe (mostly Western Europe), 1.8 million in Asia, and 600,000 in Africa. There was a slight decline in Australia.

As compared with 1951-55, cattle numbers by 1958 increased by 16.7 million in Asia, 15.5 million in South America, 13.8 million in the U.S.S.R., 13.0 million in Africa, 11.7 million in North America, 4.9 million in Europe, and 1.5 million in Australia and New Zealand.

Decline in Argentina

Many of the countries where there has been a marked increase in cattle numbers are not exporters of livestock products and the most significant development during 1958, as far as meat exports go, was the continued decline in cattle numbers in the Argentine. Since 1956 these have dropped by 13 per cent and the Argentine Government has been compelled to adopt stringent measures to reverse the trend. These have included higher prices to producers and much higher internal prices for meat to discourage the very high level of local consumption. Notwithstanding this, however, Argentine exports are not expected to recover for several years.

Cattle numbers in two other major exporting countries—Australia and Uruguay—have also declined, but in Australia the effects of the drought in 1957 and 1958 have been overcome and they should soon recover. Present killings on a heavy scale may, however, retard recovery.

In Uruguay the meat export industries face a number of difficulties and any immediate improvement in cattle numbers is unlikely.

The other important beef exporting countries—New Zealand, Denmark, and Ireland—have continued to show steady increases, but in Canada the total has dropped, which in time will bring about a reduction in slaughtering and in exports.

Of the major importing countries, in the U.K. cattle numbers increased during 1958 and are expected to do so again in 1959. The annual price review for both years has laid emphasis on the need for an increase in beef production.

In 1958 the cattle population of the United States was 96.9 million, 4 per cent above the low point reached in 1957, and by the end of 1959 can be expected to reach the 100 million mark.

Elsewhere in the world no great changes have taken place, though the marked expansion in Central America may lead to this area playing a more important part in world trade.

In Western Europe cattle numbers are rising, but this is hardly keeping pace with the increase in population and improvements in standards of living.

Attention has also been focused on developments in Africa, south of the Sahara, where the increases have been only moderate but where important changes in the structure of the industry are taking place. European farmers there have devoted more attention to commercial production and African owners, too, are becoming increasingly aware of the importance of producing for the market.

With their low domestic per capita consumption and the limited domestic market for better grade beef, several countries in this part of Africa are now seeking export markets. If living standards rise, however, in this part of the world, this could absorb any potential export surplus.

The quantity of beef that enters international trade is only a small part of total world production, but it is well known that relatively small changes in production can have a marked effect on the level and the direction of world trade. During the past year the decline in Argentine exports and the increased demand in the United States have both influenced the market; predictions as to just how long the American demand will last are difficult to make, but it is abundantly clear it will be some years before the Argentine attains its former level of exports.

Eminent American Bacteriologist at Wallaceville Animal Research Station

ONE of America's leading veterinary bacteriologists, Professor H. S. Cameron, of the University of California, is working at the Department of Agriculture's Wallaceville Animal Research Station on a Fulbright Scholarship. Professor Cameron is Professor of Veterinary Science in the School of Veterinary Medicine at Davis, California.

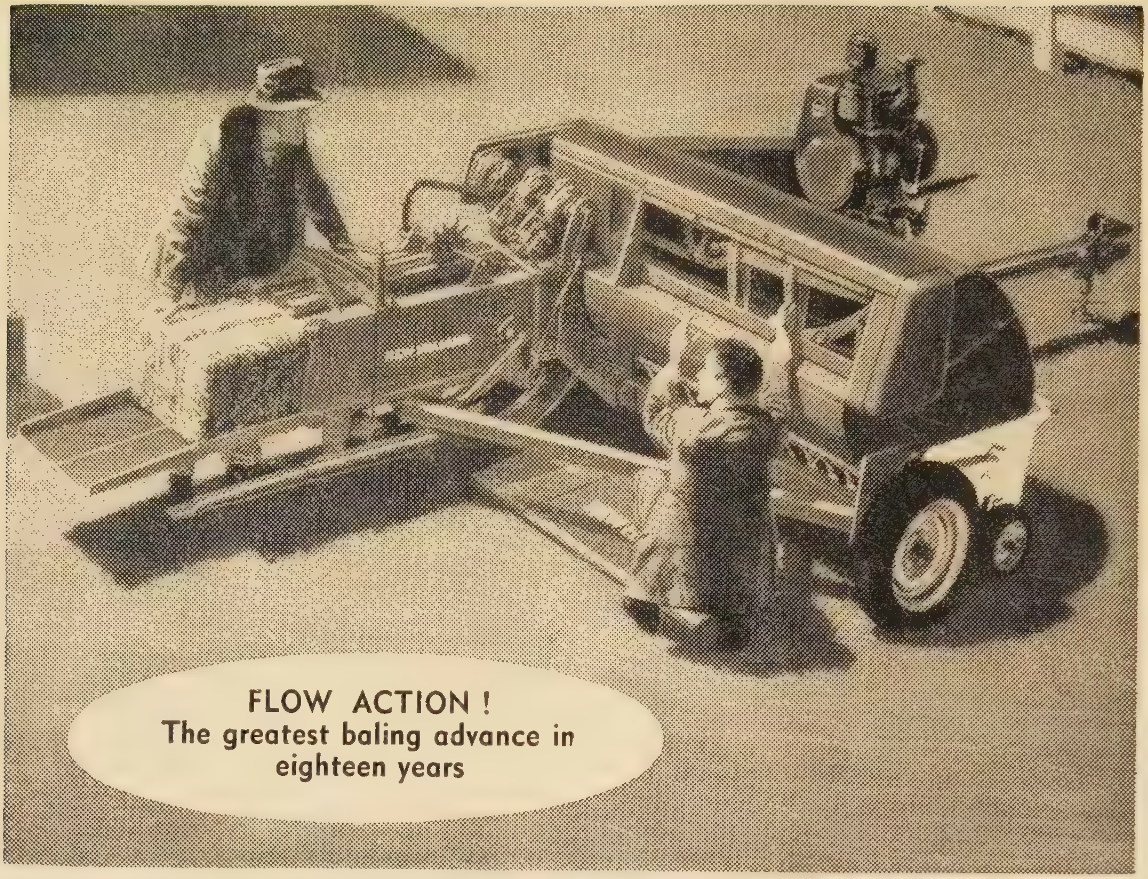
Professor Cameron is an authority on the *Brucella* group of bacteria, members of which cause contagious abortion in cattle, and epididymitis, a form of sterility in rams. Both these diseases are well known in New Zealand and considerable research on them has been done at Wallaceville, particularly in the field of prevention by vaccination.

Of some 61 papers on veterinary subjects Professor Cameron has had published, 30 have been on the *Brucella* group and the diseases they cause.

Professor Cameron was born in Scotland, but has been a United States citizen for the last 30 years. He has the degrees of Doctor of Veterinary Medicine, Master of Science, and Doctor of Philosophy, all from Cornell University. He has been associated with the University of California at Davis since 1936.

Professor Cameron.

Professor Cameron will be in New Zealand for about eight months.



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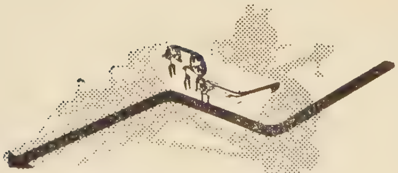

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Unthriftiness of Lambs in South Canterbury

FINDINGS and recommendations from investigations into 70 outbreaks of unthriftiness of lambs in South Canterbury over the past two summers were presented in a paper by M. C. Armstrong, Veterinarian, Department of Agriculture, Timaru, to the Lincoln Farmers' Conference this year. An adaptation of the paper follows and summarised recommendations appear in the panel below.

OUTBREAKS of serious ill thrift of lambs in South Canterbury were not widespread during the summer and autumn of 1959. Drought conditions prevailed over most of the district from early spring until the middle of March. There were, however, numerous sporadic occurrences of unthriftiness and deaths of lambs and these presented opportunities for investigations and trials, the results of which are contained in this article. It is emphasised that more information is required on the possible detrimental effects of high levels of nitrate-nitrite on appetite and digestion, the role of cobalt on heavier soils, the importance of selenium, and the pathogenic significance of *Nematodirus* species of intestinal parasites in lambs from October onward.

In this article the terms ill thrift and unthriftiness are synonymous, because in practice both are applied to define lambs failing to thrive in varying circumstances and apparently by different complexities of causes.

The intensity of unthriftiness varies greatly from farm to farm within seasons and between seasons. In different lamb flocks it varies greatly from a contrasting tail-end problem to a general effect on all lambs. We have investigated all of these, particularly several severe outbreaks in 1958 in which all lambs were affected and in which death rates were as high as 50 per cent. Unthriftiness occurred with scouring and without scouring, with appetite and without appetite, and with varying levels of blood volume.

Unthriftiness usually occurs in spring and summer and there is a general tendency for affected lambs to improve in autumn. Outbreaks have been investigated on all classes of soils from heavy downland clay loams to light stony silt and sandy loams.

Recommendations

THE use of additional cobalt is indicated on light stony soils where unthriftiness in lambs has been troublesome. Warm, wet seasons with fast, lush growth of pastures favour incipient cobalt deficiencies, and cobalt trials on other soils are worth repeating during seasons of unusually rapid pasture growth associated with unthrifty lambs.

The control of internal parasites on pastures in South Canterbury cannot be assured at present by providing known nutritional factors. Satisfactory control should be maintained by spelling pastures, cleaning up with cattle, and by the preventive use of fine-particle phenothiazine. Care should be taken not to give phenothiazine to partially dehydrated lambs under dry conditions off dry feed.

Where *Nematodirus* infestation is suspected before weaning, trials with bephenium embonate ("Frantin") are suggested.

No recommendations can be given at present for the use of selenium and field trials with this will be continued in the future.

Occurrence on Light Soils

The most severe losses occurred over large areas of improved stony soils in the summer of 1957-58. They were limited geographically to stony silt and sandy loams of the following description: Ashwick, Lismore, Steward, Eyre, Paparua stony silt loams, and Pukeuri shallow silt loam. This light land ill thrift coincided with a spring and summer of unusually abundant growth of foliage. It was apparent in early November in lambs six to eight weeks of age and became most severe after weaning time. Trouble was experienced on pasture, lucerne, and rape.

Occurrence on Heavy Soils

On heavy soils the ill thrift tends to appear in a varying proportion of tail-end lambs before weaning and often at a time when the tops are being drafted as fats. This occurs in seasons of plenty as well as in seasons of scarcity. Some severe outbreaks in November with high incidence and big losses have occurred on heavy land where stock density was high. Outbreaks tend to be more severe under set stocking systems and in the absence of pasture spelling and control by cattle.

Nature of Investigations

During the investigations of 70 outbreaks over the past two summers we have recorded information on management and lamb health. Affected lambs were examined clinically and some typical ones killed for post-mortems. Freshly killed lambs were preferred for true parasite assessments and blood pictures. As a general rule gut specimens were submitted to the Wallaceville Diagnostic Station for counts of parasites, bacterial examinations, and liver estimates of cobalt and copper.

Numerous cobalt supplement trials were conducted on all classes of land with particular attention to the areas of severely affected light land in 1958. In three of these trials the benefit of an iron, copper, and cobalt mixture was compared with that from cobalt alone. Since early February this year the Department of Agriculture has conducted 44 cobalt trials mainly on heavier fertile soils, on which a percentage of unthrifty lambs was more apparent than on the light land soils, where cobalt had been extensively applied.

In addition seven selenium trials have been conducted—three on cobaltised light land, two on heavy land, and two on non-cobaltised light land. The last four trials were tests of selenium with and without cobalt.

Findings

1. Copper

Normal levels of liver copper existed on all but two farms where odd livers had moderately low copper estimates. On one of these farms a copper supplement was of no benefit when used in a trial with and without cobalt.

2. Iron

In three trials with severe ill-thrifty lambs on light land soils in 1958 iron was used in combination with copper and cobalt and no benefit was obtained beyond that derived from cobalt alone.

3. Cobalt

The existence of a seasonal deficiency of cobalt over extensive areas of improved light land during the 1957-58 summer was indicated by low deficiency levels in livers and by the results of cobalt trials with unthrifty lambs on various pastures and on rape (Armstrong, 1958). This was reported in the "Journal" for September 1958. Where

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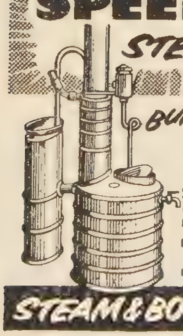

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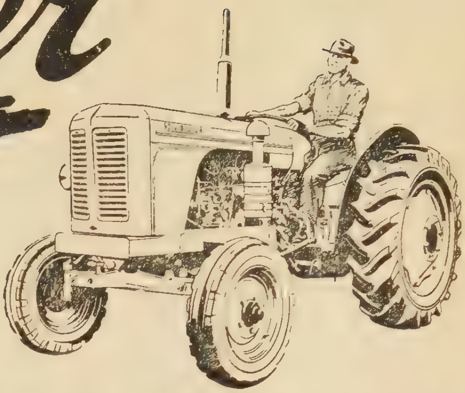

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cobalt deficiency existed appetites were depressed and blood volumes low.

This occurrence of incipient cobalt deficiency was undoubtedly induced by the rapid abundant growth of foliage on leached soils adequately topdressed with lime and phosphate. No molybdenum had been used on these soils, but some had been heavily treated with lime at 6 tons per acre within six years. No correlation could be established, however, between the severity of ill thrift and the quantity of lime used per acre during the previous six years. More information is required to show what detrimental effects various levels of soil pH may have on cobalt availability in Canterbury soils.

It was shown in two trials that the presence of a moderate cobalt deficiency could be alleviated by short pasture or sparse grazings where soil contamination of food occurred. Because soil contains about 30 times as much cobalt as pasture, it is considered that the ingestion of soil with short or heavily grazed pasture provides sufficient cobalt for lambs under moderate deficiency conditions (Andrews and others, 1958).

New Zealand observations are that seasons favouring lush growth of pastures tend to cause the development of cobalt deficiency disease and the cobalt content of pastures tends to decrease in spring and summer and increase in late autumn and winter. The effect is probably a double one owing to longer, cleaner pasture with less soil contamination and to a lower cobalt uptake in rapidly growing plants.

In the 44 cobalt trials started in South Canterbury since early February 1959, mostly on heavier soils, no responses have been obtained. Pasture conditions for the first few weeks were short and dry and when growth did occur in March and April it was not rapid, long, and lush.

Though extensive seasonal cobalt deficiency was found on light land areas in 1958, there is no information that the heavier soils are similarly affected in South Canterbury and the role of cobalt on heavy land during seasons of lush growth has to be examined in the future.

4. Selenium

In our seven selenium trials this year we have recorded small favourable responses in all of them on various soils. Improved weight gains averaging between 2 and 5 lb per head were obtained in 60 to 70 days during autumn (14 February to 8 May 1959) on ordinary pasture, irrigated pasture, and a mixture of turnips and grass. It is pertinent to record that there was no history of white muscle disease on any of these farms.

These results, with those recorded by McLean and others (1959) and the unpublished information from the Department of Agriculture, suggest that a selenium deficiency may retard the optimum thrift of lambs during spring, summer, and autumn in Canterbury.

5. Nitrogen

Unthrifty lambs killed on two farms in April 1959 showed chocolate coloured arterial blood. With these rare exceptions there have been no clinical or post-mortem signs of nitrate-nitrite poisoning associated with outbreaks of ill thrift. Information is required nevertheless on the significance of sub-lethal amounts of nitrate-nitrite in the ill-thrift complex.

6. Internal Parasitism

In South Canterbury our investigations have shown pathogenic counts of parasites in all severe outbreaks of unthriftiness, and the milder outbreaks of tail-end unthriftiness have been associated with either pathogenic or near pathogenic counts in all but a few.

The widespread occurrence of unthriftiness on the light land areas in 1957-58 was a "clean tailed", non-scouring disease in which consistent high counts of *Ostertagia* species of small stomach worms were present. Copper sulphate-nicotine sulphate and ordinary dose rates of phenothiazine were not found to be effective. Good growth responses of lambs, however, followed the removal of *Ostertagia* species by increased dose rates of fine-particle phenothiazine equivalent to 1½ fl. oz. of a phenothiazine containing at least 60 per cent of particles under 5 microns in size. This gave field confirmation to the experimental work of Thomas and Elliot at Wallaceville (1957).

Investigations in the spring, summer, and autumn of 1958-59 in 32 outbreaks have shown the presence of significant counts of *Nematodirus* species of intestinal worms in 30 (94 per cent) out breaks; *Ostertagia* species were present in significant numbers in 22 outbreaks or 70 per cent; and *Trichostrongylus* species were significant in 12 or 37 per cent. *Trichostrongylus* species were accompanied by *Nematodirus* and *Ostertagia* as mixed infestations. Dirty tails and scouring occurred where *Nematodirus* or *Trichostrongylus* were significant.

In several outbreaks on heavy land severe early ill thrift and losses of lambs in November-December were associated with high counts of *Nematodirus* species. Many affected lambs had a secondary bacterial infection and the combined effects were severe and usually fatal. In the United Kingdom acute *Nematodirus* disease causes serious losses and unthriftiness in young lambs from six weeks of age onward (Scarnell and Rawes, 1959). The drug of choice to use at present is bephenium embonate ("Frantin") which is efficient for both treatment and prevention. The pathogenic significance of *Nematodirus* infections in New Zealand is not

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Book Review

"The Scientific Principles of Crop Protection": Hubert Martin

THIS book will be found useful for reference by students, research workers, and others who want to know something of all phases of crop protection. As is evident from the topics discussed, there are many facets to this subject. They include fungicides and insecticides, biological control, the nature of plant resistance, weedkillers, fumigants, seed and soil treatments, nutritional and climatic factors, repellants, and traps. The emphasis throughout is on principles.

The book is very readable, full of information, and copiously annotated with references to published research. Of particular value are the references given immediately after each topic discussed.

This is the fourth edition, the previous one having been printed in 1940. The author, who is the Director of the Science Service Laboratory, Department of Agriculture, Ontario, Canada, has accounted for many advances in the use of chemicals developed since the Second World War.

—K.C.

Edward Arnold Ltd., London. 65s.

known and trials with bephenium embonate are necessary.

Internal parasitism was most severe under conditions of high stock density and where there was inadequate spelling of pastures from sheep. There were many good recoveries from unthriftiness by worm control alone, especially on heavy soils. Furthermore, in both our cobalt and selenium trials the maximum and most regular weight gains were obtained in the presence of worm control. The great advantage in weight gains by controlling parasites in addition to the use of cobalt and selenium has emphasised the harmful nature of the parasites encountered in these outbreaks.

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Swedish Landrace Pigs for Breeding Scheme at Ruakura

PUREBRED Swedish Landrace pigs imported from Australia by a New Zealand breeder are to be lent to the Ruakura Animal Research Station, where under the direction of D. M. Smith, Senior Principal Scientific Officer, their potentialities will be investigated and their possible use in the hybrid breeding programme explored.

THE first of the stock, an in-pig gilt, arrived at Ruakura on 21 August after a month's quarantine in this country. She farrowed a litter of 10 piglets in mid September.

Acquisition of Landrace stock opens the possibility of using the three-breed rotational cross system of breeding (Berkshire-Large White-Landrace) and thus keeping hybrid vigour up to a maximum. This system has been very successfully exploited in America and was studied there by Mr Smith several years ago.

The sow and her progeny will be tried out at Ruakura under standard conditions to compare growth rate, feed conversion efficiency, and carcass quality with the same qualities in New Zealand pigs, on which a great deal of data has been assembled at Ruakura.

Two Swedish Landrace boars are already in the country and two more are coming. An importing breeder has promised to make a total of six sows and two boars available to Ruakura. The Pig Producers Council, which has supported and encouraged the hybrid breeding work already done at Ruakura, is showing keen interest in the possibilities presented by the acquisition of this new breed for use in the scheme.

The Swedish Landrace is performing very well in England. Some stock have gone to Northern Ireland, whence importation to New Zealand is permissible because of the absence of rhinitis there.

Mr Smith is enthusiastic about the future possibilities of pig improvement in New Zealand offered by use of Swedish Landrace boars across crossbred sows.

Mob Stocking of Ewes at Weaning

RUNNING the ewes in large mobs after weaning is a management practice now widely adopted, but weaning is not done early enough on many farms to get the best results from mob stocking. Research has shown that once lambs are three and a half to four months old they will do as well away from their mothers provided plenty of clean, fresh grass is available for them. This can be arranged by increasing the stocking rate for better control of the pastures during the spring flush on part of the farm and saving for the weaned lambs the paddocks from which the sheep have been removed; the top growth in these paddocks is controlled by the cattle.

By early weaning the mob of ewes can be used more or less as a mowing machine at a time when they can do some real good in cleaning up roughage from paddocks in turn, in cleaning up rough gullies and shady faces, and in the control of bracken fern, weeds, and small second growth. They can be crushed on to areas that want severe treatment or used on the poorer pastures while the best of the feed is saved for fattening stock.

It is surprising how white clover will flower and set seed after a mob of ewes has been crushed on to a paddock in November or early December. Paddocks that have been so treated and then spelled for eight to 10 weeks provide excellent feed for lambs in late February and March and the clover will thicken up through the reseeding. Having the ewes in a mob before shearing is of course a great convenience.

—*E. C. AYSON,*
Farm Advisory Officer,
Department of Agriculture,
Wairoa

Boron for Swedes and Lucerne

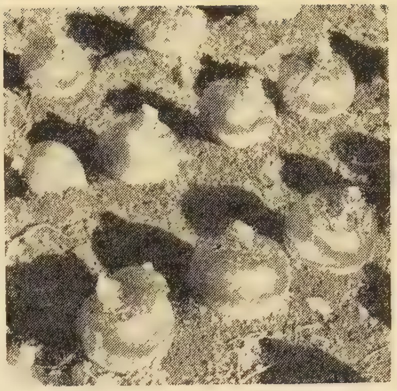
SOME soil types lack a freely available supply of the element boron, without which swedes will develop the condition known as brown heart (or mottled heart) and lucerne stands become unthrifty, stunted in growth, and show a yellow discolouration of the leaves instead of the healthy uniform green. Boron can be supplied in several forms—as borax, as a borate, or incorporated with a fertiliser as in borated superphosphate. In all cases care should be taken to ensure that the correct quantities are applied and that even distribution is obtained.

WITH swede crops the best time to apply boron is broadcast before the seed is sown. No commercially available material containing boron has been found which will supply the element freely to the plants without causing some germination injury; therefore it is unwise to mix seed with such a material.

In severe cases 50 per cent of the seedlings can be damaged, and injury is greatest in a dry season. Though germination injury is not always severe or readily apparent to the farmer, trials have clearly shown that yields can be seriously reduced by giving an initial check to the seedlings.

Rates of application vary, the tendency being toward higher rates on soils containing a greater percentage of sandy material and inclined to dry out. Only a measure of control is aimed at, as complete elimination of brown heart would require quite uneconomic applications of boron. Recommended rate is 10 lb per acre of borax or its equivalent of other materials on soils mildly deficient and up to 20 lb per acre on soils proven to be markedly deficient. Some varieties, including Calder and Wilhelmsburger, have a measure of resistance to brown heart.

With lucerne boron should be broadcast well before the inoculated seed is sown, and the recommended rate is the equivalent of 20 lb of borax per acre. Annual topdressing at the same rate is required for best growth, and the application is best made in late winter-early spring, before growth begins, or after the first cut or grazing has been taken. It can be mixed with superphosphate, potash, or other fertilisers being applied at that time. Even distribution is essential to avoid poor patches.



Symptoms of boron deficiency are most marked during continued dry weather and a deficiency of boron can result in a significant reduction in yield. Liming renders boron less available to plants and where lime is required, rates higher than 20 lb of boron may be of benefit in deficient areas.

—*R. W. MOODY,*
Farm Advisory Officer,
Department of Agriculture,
Rotorua

Control of Potato Tuber Moth

IN dry seasons in the North Island, and especially in Hawke's Bay on the lighter soils, severe damage is caused to main crop potatoes by the caterpillar of the potato tuber moth. If no precautionary measures are adopted, the whole crop can become affected and its commercial value reduced accordingly. The caterpillar does not thrive under damp conditions, so that in a wet season damage to crops is practically negligible.

THE potato tuber moth is a small brownish-grey moth about ½ in. long, and though night flying, it can be easily seen during the day when disturbed. In a growing crop the female lays its eggs in the eyes of exposed tubers or at the bases of the stems. The larvae then burrow into the tubers, rendering them useless for commercial purposes and also for seed.

The first precaution in controlling this pest is to plant the tubers at least 6 in. deep. Rows should be no less than 30 in. apart; the wider the rows are the better, as more soil is available for ridging or moulding to obtain complete coverage of the developing potatoes. Periodical moulding is absolutely essential, as exposed tubers are open to direct attack from the moth. Widely spaced rows also allow for only a minimum amount of damage by machinery to the foliage of the growing plants.

The moth is generally on the wing in early January, but in a dry season may be noticed a month or six weeks earlier.

Spraying with lindane 20 per cent emulsion or dieldrin has proved the most effective treatment; for ground application the rate is 2 pints in 100 gallons of water per acre and for aerial application 2 pints in 20 gallons. To keep a crop clean regular sprayings every 14 days are necessary, but if it rains, applications must be made again after the topsoil dries out. Thorough moulding must also be maintained during the spraying period.

Failures have been reported with both materials, but these have mainly been attributed to poor distribution, irregular applications, and poor moulding.

During digging the sacks should be sewn immediately and at no time should the haulms be placed on the top of the sacks.

Damage is still likely to occur during storage. If potatoes are stored in sacks, the outsides should be sprayed regularly and this also applies to potatoes which are pitted and covered with straw. Whichever material is used, it should not be applied direct on to the tubers if they are intended for consumption.

—*F. H. COLLIN,*
Fields Instructor,
Department of Agriculture,
Hastings

MANNINGS

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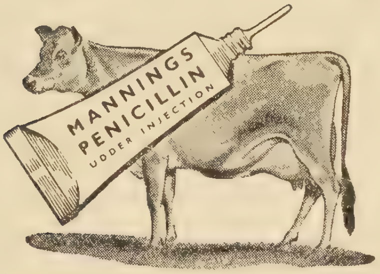

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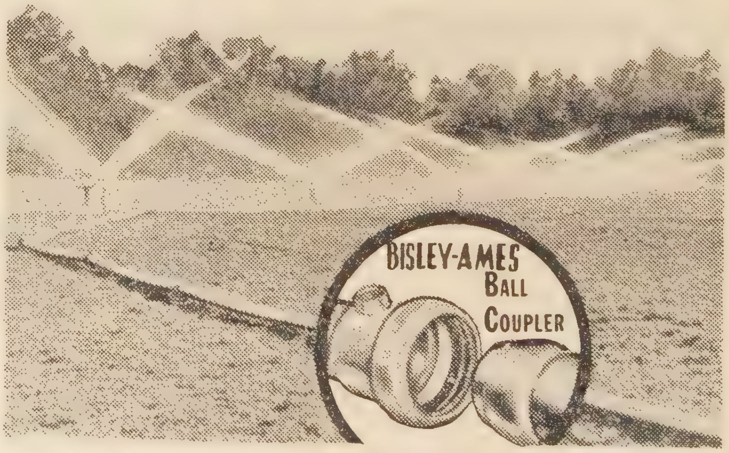

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Dehydrated Lucerne Meal as Source of Vitamin A for Laying Pullets

By J. EDMONDSON,
Poultry Experimentalist,
Department of Agriculture,
Upper Hutt, and
F. C. BOBBY,
Chief Advisory Officer (Poultry),
Department of Agriculture,
Wellington

THE need for poultry farmers to supplement a layers' diet with vitamin A was shown by a feeding trial at the Department of Agriculture Poultry Demonstration Plant, Upper Hutt, in 1950, the results of which led poultry farmers and mash manufacturers to incorporate feeding fish oils and later synthetic vitamin A in laying mashes. It also resulted in commercial poultry farmers gradually ceasing to feed fresh green feed to their laying stock with a consequent loss of yolk colour in eggs. About this time a good-quality dehydrated lucerne meal was marketed in New Zealand for the first time and the Department demonstrated the value of inclusion of this meal in laying rations for colouring the yolks of eggs.

← Dehydrated lucerne meal suitable for poultry is manufactured from the sort of young, succulent lucerne shown here.

THE use of dehydrated lucerne meal raised the questions of how much vitamin A this meal supplied to laying stock and whether the amount of synthetic vitamin A normally added to laying mashes should be amended or even dispensed with where an adequate quantity of good-quality dehydrated lucerne meal is included in a laying mash. To answer these questions in a practical manner a feeding trial was held, and a description of this trial with its results is given here.

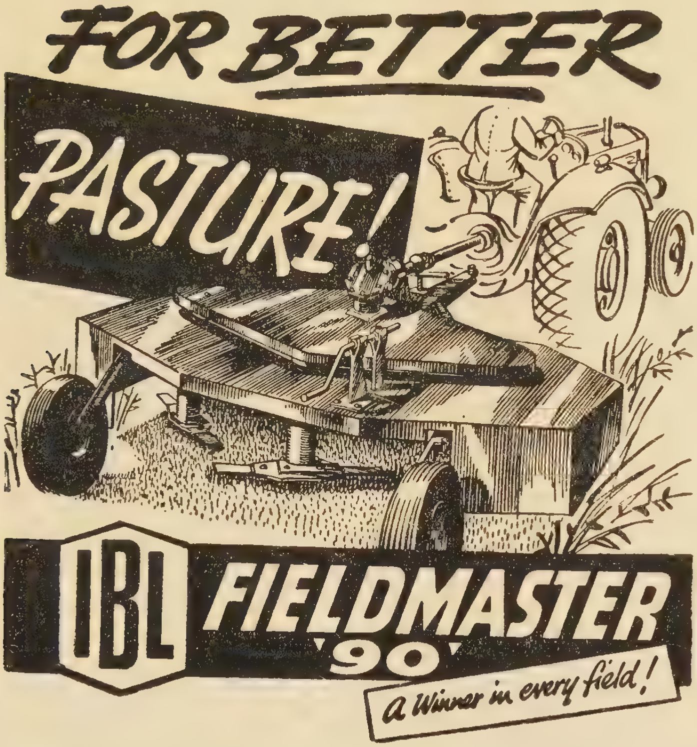
Vitamin A promotes appetite, digestion, and growth and increases resistance to disease. It is essential for full production and good hatchability. In laying rations Vitamin A may be supplied in two ways:

1. Vitamin A derived from fish oils or as a synthetic.
2. Provitamin A (carotene), which can be converted into true vitamin A in the bird's body. Sources of carotene are such foods as grass, clover, lucerne, and other green foods, and carrots and yellow maize.

When birds have access to good pasture vitamin A requirements can

Lessons from the trial were—

1. Vitamin A requirements of laying pullets were adequately met when 4 per cent of good dehydrated lucerne meal was added to the diet, compared with a ration to which no lucerne was added but which was fortified with the requisite amount of vitamin A. Yolk colour was greatly superior with a diet containing lucerne meal.
2. Laying pullets housed in open-fronted sheds facing east-north-east so benefited from sunlight that no vitamin D was required to be added to the diet.



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be met from the green food they eat. Birds kept intensively can be supplied with freshly cut greens. In both cases a vitamin A deficiency can occur when, for instance, pasture becomes burnt out in a summer drought or growth is slow in winter. Carotene content is highest in young, succulent growth and can be very low when grasses are mature and growth is rank and tough. As such circumstances often arise, it has become common practice to ensure an adequate and consistent supply of vitamin A in the ration. Any additional vitamin A derived from pasture or cut greens is looked on as a "nutritional extra".

Grass or lucerne cut in early growth and dehydrated without delay provides good-quality meal rich in vitamins—particularly vitamin A—and also in a valuable pigment (xanthophyll) responsible for giving rich yolk colour. In recent years good-quality, properly dehydrated lucerne meal has appeared on the market in New Zealand. It is much superior to the variable and poor sun-dried lucerne and lucerne hay meals previously obtainable which were of little value in poultry feeding.

Lucerne meal has therefore become popular, particularly where large intensive laying flocks are kept. This appears to be mainly because it is a particularly rich source of pigments required for the good yolk colour demanded by housewives. The inclusion of 4 per cent in a ration is adequate for this purpose. Though the price of lucerne meal is rather high, it is more economical to use than to grow, cut, and carry fresh greens to get the same results.

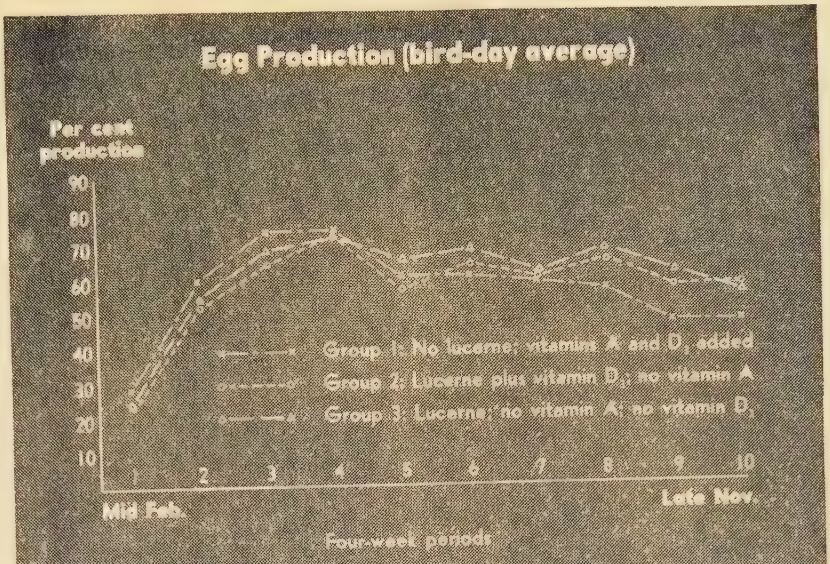
Lucerne Meal Rich Source of Vitamin A

Probably not so well appreciated is the fact that good-quality lucerne meal is a rich source of vitamin A in the form of carotene. Often this is not considered when a mash is being formulated, with the result that the amount of vitamin A from lucerne meal plus that added as a supplement far exceeds a bird's actual requirements. Obviously some economy can be made without any detrimental effect on the nutritive value of a ration.

The aim of the feeding trial at the Poultry Demonstration Plant was to measure the effect of lucerne meal as the sole source of vitamin A when used at a level of 4 per cent of the total ration, commonly recommended for satisfactory yolk colour.

In the same feeding trial and as a further variation a group of laying pullets was fed on a ration depending on lucerne meal for the supply of vitamin A, but with no vitamin D_3 added. It is known that in the presence of sunlight birds can manufacture their own supply of vitamin D_3. The ultra-violet rays of sunlight react on organic substances in the skin to synthesise vitamin D_3. When birds are exposed to sufficient sunlight enough of this vitamin is produced for nutritional requirements. As the laying pullets were housed in open-fronted sheds facing roughly east-north-east, a good opportunity was presented to measure, too, the effect of exposure to sunlight on laying birds fed a ration to which no vitamin D_3 had been added.

LUCERNE PROVIDES VITAMIN A FOR POULTRY



	Group 1	Group 2	Group 3
Cost of mash per ton	£28 4s. 8d.	£28 3s. 0d.	£27 18s. 2d.
Food per dozen eggs	5.39 lb	5.47 lb	5.17 lb
Cost of food per dozen eggs	18.32d.	18.31d.	17.33d.
Average per cent production	59	58	62
Average eggs per bird (40 weeks)	162	160	169
Number of deaths per 80 birds	1	2	3

Method

The trial started in mid February 1958 and continued for 40 weeks. Three groups of 80 White Leghorn x Australorp pullets at point of lay were used, each group being divided into two pens of 40 housed intensively.

Egg production, food consumption, and mortality were recorded. The groups were fed as follows:

Group 1—A mash without lucerne meal; with vitamins A and D_3 added.

Group 2—A mash with lucerne meal; with D_3 added but without vitamin A added.

Group 3—A mash with lucerne meal; without vitamin A or D_3 added.

The mash ingredients are given at the bottom of the next column.

These "all mash" rations were fed dry in mash troughs and were available to the laying pullets at all times. No other food was fed apart from a free choice supply of oyster shell and hard (insoluble) grit.

Cost of Mash

Cost of mash was based on average ruling prices of ingredients. No charge is made for mixing and transport to the farm, as such charges are common to all groups and therefore do not influence comparisons made between groups.

RESULTS OF TRIAL

Results of the feeding trial are given in the accompanying graph and table. As two different aspects of nutrition

MASH INGREDIENTS

	Group 1 lb	Group 2 lb	Group 3 lb
Bran	100	100	100
Pollard	60	60	60
Ground wheat ..	1,000	920	920
Ground maize ..	200	200	200
Ground barley ..	300	300	300
Meat meal (60 per cent)	200	200	200
Milk powder ..	80	80	80
Salt	10	10	10
Manganese sulphate	¼	¼	¼
Oyster shell dust ..	50	50	50
Dehydrated lucerne	—	80	80
Vitamin A ..	+	—	—
Vitamin D_3 ..	+	+	—
	2,000¼	2,000¼	2,000¼
Approximate estimated protein, per cent ..	17	17	17
Approximate estimated calories, per lb	850	850	850

are examined, these are dealt with separately.

Lucerne Meal as Source of Vitamin A

The main purpose of the trial was to determine the effect of good-quality lucerne meal as the sole source of vitamin A. Groups 1 and 2 are therefore compared: Group 2 was fed 4 per cent lucerne meal but received no added vitamin A, and Group 1 had added vitamin A but no lucerne meal.

Food Cost

Even though lucerne meal at £40 per ton was the most expensive ingredient of the ration, its inclusion did not materially affect the cost of the ration, because a saving on the cost of vitamin A omitted cancelled out the extra cost of the lucerne meal which replaced the wheat meal.

Egg Production

Groups 1 and 2 gave an average egg production of 59 and 58 per cent respectively over 40 weeks from point of lay, both of which are satisfactory.

Efficiency of Food Conversion

The efficiency with which food was converted into eggs, expressed as pounds of food to produce a dozen eggs, was almost the same for both Groups 1 and 2, indicating that neither ration was superior.

Economic Efficiency

As cost per ton, efficiency of food conversion, and egg production were practically the same in both groups, it is to be expected that "economic efficiency", expressed as the cost of food to produce a dozen eggs, would be similar. This proved to be so, the cost being 18.32d. per dozen eggs for Group 1 and 18.31d. for Group 2 (lucerne meal group).

Vitamin A Reserve

Vitamin A above a bird's immediate requirements is normally stored in the liver as a reserve for use when needed. A fair estimate of the adequacy of vitamin A in a ration can therefore be made by a vitamin A assay of the liver to determine the reserve.

Livers from six birds in each group were tested separately and the vitamin A reserve assessed. Group 1 (no lucerne meal) showed an average content of 136 international units per gramme, which is considered as more than adequate. Group 2 (lucerne meal) gave an average of 370 international units per gramme, almost double that of Group 1. Liver assays for vitamin A therefore indicated that both rations under test supplied adequate vitamin A, which was utilised by the birds and left a good reserve.

Yolk Colour

At intervals throughout the trial eggs were examined and eggs from birds in Group 2 (lucerne meal) had consistently good yolk colour, whereas eggs from birds in Group 1 (no lucerne) had pale lemon yolks. This aspect is most important in marketing, as even though both types of eggs have similar nutritive value, the housewife does not care for eggs with pale yolks.

This feeding trial showed that 4 per cent of good dehydrated lucerne meal in a laying pullets' ration in addition to giving satisfactory yolk colour supplied the total vitamin A requirements. Egg production and economic food efficiency were just as good as from a ration containing added vitamin A but no lucerne meal.

Lucerne Meal Must be Good

The test was carried out with good-quality dehydrated lucerne meal. The minimum requirements of a lucerne meal in this category would be approximately:

Fibre: Not more than 20 per cent.
Protein: Not less than 20 per cent.
Vitamin A: Not less than 100,000 international units per pound.

Where lucerne meal is used as a source of vitamin A the vitamin A content should be known. A poultry farmer mixing his own mashes or a mash manufacturer should expect to receive a guarantee of minimum vitamin A potency of the lucerne meal he buys.

Sunlight as Source of Vitamin D

Group 3 was fed a ration similar to Group 2 except that no vitamin D_3 was added. This meant that the laying pullets in this group were entirely dependent on ultra-violet rays of sunshine to enable them to manufacture their own vitamin D.

The graph and table show that the laying pullets in Group 3, depending on lucerne meal as a source of vitamin A and on sunlight for vitamin D, laid slightly better and utilised food rather more efficiently and at a lower cost per dozen eggs produced than those fed on rations 1 and 2. None of the differences was significant, though the results indicate that the ration fed to Group 3 was in no way inferior.

The result of this test could lead to serious misapplication in practice if the following points are not clearly understood:

1. The vitamin D for Group 3 came entirely from sunlight.
2. The houses were open fronted and faced roughly east-north-east, thereby allowing sunlight to take effect.
3. Hours of sunlight during the winter of the feeding trial were rather more than average.

Recommendation

Though the effect of sunlight on a bird's vitamin D requirements must be considered in poultry nutrition, the cost of fortifying a mash is low (about 5s. a ton). Many birds because of type of housing or weather will not receive sufficient exposure to sunshine, and it would generally be wise to incorporate a vitamin D-rich additive in the ration. Any vitamin D manufactured by the birds themselves through exposure to sunlight would be looked on as a "nutritional extra".

◆

Meteorological Records for August

Station	Height of station above M.S.L. (ft.)	Air temperatures in degrees (Fahrenheit)				Rainfall in inches					Bright sunshine hours
		Approx. mean	Difference from normal	Absolute maximum and minimum		Total fall	No. of days of rain	Difference from normal	Maximum fall		
				Maximum	Minimum				Amount	Date	
Kerikeri	240	52.8	+ 1.8	68.7	35.4	9.88	23	+ 3.05	2.87	18	139
Auckland	160	53.6	+ 1.4	67.0	42.6	5.01	19	+ 0.59	2.01	20	165
Tauranga	12	50.6	+ 0.9	64.8	32.0	3.15	13	— 1.60	1.25	2	161
Ruakura	131	49.2	+ 0.7	63.3	38.9	4.04	15	— 0.69	1.23	2	128
Whakarewarewa ..	1,006	47.6	+ 2.1	60.9	30.3	2.65	13	— 2.45	0.51	21	124
Gisborne	14	49.7	+ 0.5	67.0	33.0	5.88	13	+ 2.98	2.07	21	163
New Plymouth ..	160	51.4	+ 1.8	62.1	35.3	2.30	15	— 3.45	0.39	2	159
Karioi	2,125	43.8	+ 1.8	65.6	26.0	1.77	12	— 2.44	0.41	6	
Napier	5	49.8	+ 0.7	67.0	32.2	2.77	8	— 0.16	1.25	10	180
Wanganui	72	49.2	+ 0.1	67.2	34.8	1.01	10	— 1.94	0.34	7	159
Palmerston North ..	110	49.0	+ 1.3	67.0	31.2	1.22	10	— 2.53	0.34	7	154
Waingawa	340	46.8	+ 0.9	63.0	28.0	1.29	14	— 2.89	0.30	7	169
Wellington	415	49.6	+ 2.0	62.1	37.3	1.85	15	— 2.80	0.47	3	175
Nelson airfield ..	5	46.0	+ 1.2	63.8	29.9	3.27	7	+ 0.13	1.56	2	
Blenheim	12	46.9	+ 0.6	63.3	30.2	1.43	5	— 0.90	0.75	2	204
Hokitika	15	45.2	+ 0.5	56.1	28.0	6.48	14	— 2.56	1.83	14	177
Hanmer	1,270	41.6	+ 0.2	62.0	22.7	1.21	9	— 2.37	0.70	7	174
Christchurch ..	22	45.2	+ 0.9	65.0	28.4	0.54	4	— 1.51	0.38	2	195
Ashburton	323	44.0	+ 0.3	66.3	23.2	0.35	3	— 1.97	0.23	2	192
Timaru	56	44.2	+ 0.4	61.8	28.0	0.28	3	— 1.18	0.14	2	184
Alexandra	520	40.8	— 0.6	63.0	23.4	0.23	5	— 0.40	0.11	6	171
Taieri	80	43.6	— 0.1	66.0	24.5	0.63	5	— 1.11	0.33	14	156
Invercargill airfield ..	0	43.4	+ 0.4	59.9	26.4	2.35	17	— 0.59	0.73	16	127
Chatham Islands ..	150	45.6	— 0.6	55.9	35.6	1.78	19	— 1.39	0.53	4	

RECENT RESEARCH WORK

Lime, Superphosphate, and Potash on Irrigated Lucerne

ON Lismore stony silt loam lucerne which is intensively irrigated and only cut for hay tends to lose its productivity fairly rapidly, in spite of liberal liming and moderate topdressing with superphosphate. The weakening of the stand is accompanied by an ingress of weed grasses, browntop in particular.

According to the Soil Bureau, Department of Scientific and Industrial Research, Lismore soils contain illite, a clay mineral which is relatively rich in potassium. Potash responses on pasture have been only small and potassic fertilisers are therefore not popular in Mid Canterbury.

By removal of hay without any feeding back, the soil reserves of potassium must gradually decrease. If a good irrigated lucerne stand produces 10,000 lb of dry matter a year with a potassium content of about 3 per cent, more potassium is extracted from the soil than is contained in 5 cwt of muriate of potash.

On a border diked area (of rather low soil fertility) which was sown in New Zealand Certified lucerne on 29 December 1954 a trial was laid down in which the effects of rates of lime, superphosphate, and potash would be determined. To give the lucerne a good start the following applications were made at time of sowing:

1. Lime at 2¼ tons per acre
2. Superphosphate at 3½ cwt per acre
3. Muriate of potash at 3 cwt per acre

The average pH in the top 3 in. was thus raised from 6 on 20/9/54 to 6.7 at laying down. Soil test results for calcium, potassium, and phosphorus were also much increased.

DESCRIPTION OF TRIAL

THREE rates of lime (0, 5, and 10 cwt per acre), three rates of superphosphate (0, 2, and 4 cwt per acre), and three rates of muriate of potash (0, 2, and 4 cwt per acre) were applied annually in all possible combinations, giving a total of 27 treatments. The applications were made in July or August of 1955, 1956, and 1957.

The trial was mown four times a year to a height of 1 to 2 in. and all herbage was removed from the plots.

During 1955-56 one-third of the trial was irrigated whenever the available soil moisture was reduced to half, one-third was irrigated at wilting point, and one-third was not irrigated. Yields from the unirrigated part of the trial were excluded from the results. During 1956-57 and 1957-58 the whole trial was irrigated at about 50 per cent available soil moisture.

RESULTS

THE EFFECT OF LIME

In the following tables yields for each lime rate have been averaged over all rates of superphosphate and potash.

Relative Dry Matter Production (nil = 100)

Rates of lime	Lime means		
	1955-56	1956-57	1957-58
Nil	100	100	100
5 cwt	98	99	100
10 cwt	99	99	99

Average Dry Matter Production per Annum

Rates of lime	Lime means	
	lb per acre	Relative (nil = 100)
Nil	9,730	100
5 cwt	9,610	99
10 cwt	9,620	99

Annual applications of lime did not give any response in production, but the soil acidity was already sufficiently reduced when the trial was laid down. The pH in the top 3 in. was further raised on the plots which received lime during the trial:

pH on 24/7/57 (Average)

No lime	6.70
Lime at 5 cwt per acre per annum	6.79
Lime at 10 cwt per acre per annum	6.88

THE EFFECT OF SUPERPHOSPHATE

All yields have also been averaged according to phosphate rates:

Relative Dry Matter Production (nil = 100)

Rates of superphosphate	Superphosphate means		
	1955-56	1956-57	1957-58
Nil	100	100	100
2 cwt	110	103	107
4 cwt	111	102	106

Average Dry Matter Production per Annum

Rates of superphosphate	Superphosphate means	
	lb per acre	Relative (nil = 100)
Nil	9,290	100
2 cwt	9,840	106
4 cwt	9,830	106

The response to superphosphate at 2 cwt per acre was significant for all seasons (at 1 per cent level for 1955-56 and 1957-58 and at 5 per cent level for 1956-57). The soil test for phosphorus was also significantly increased.

THE EFFECT OF POTASH

Finally yields have been averaged according to potash rates:

Relative Dry Matter Production (nil = 100)

Rates of muriate of potash	Potash means		
	1955-56	1956-57	1957-58
Nil	100	100	100
2 cwt	101	102	108
4 cwt	103	105	111

Average Dry Matter Production per Annum

Rates of muriate of potash	Potash means	
	lb per acre	Relative (nil = 100)
Nil	9,350	100
2 cwt	9,700	104
4 cwt	9,920	106

Potash did not give a significant response in 1955-56. In the second season significant responses to potash (at 1 per cent) were recorded only when it was applied at 4 cwt per acre. All differences in yield were, however, significant (at 1 per cent) for 1957-58.

COMMENTS

1. Lime did not give a yield response on irrigated lucerne after the pH was raised to 6.7 at sowing.

2. Small but consistent responses to superphosphate were obtained, but 4 cwt per acre per annum did not prove to be superior to 2 cwt per acre per annum.

3. Responses to muriate of potash increased over the three-year period. During 1957-58 4 cwt per acre gave a significantly greater response than 2 cwt per acre.

4. No interactions of any of the three chemicals were recorded for any season.

5. There was no indication that stimulation of irrigated lucerne with superphosphate and potash had more than only a minor suppressing effect on the growth of weed grasses.

—*J. LAMMERINK*

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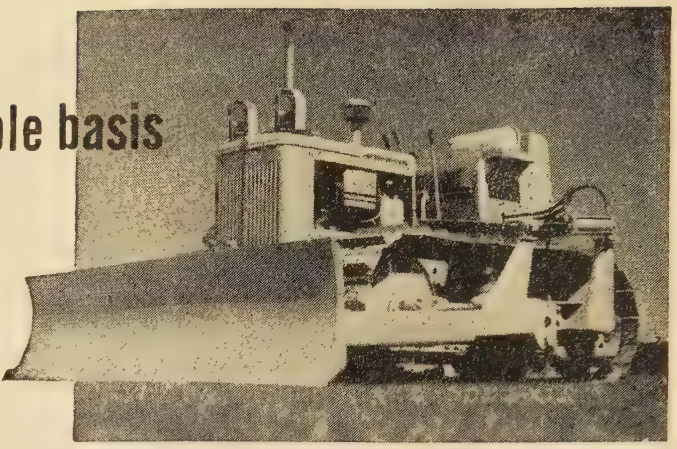

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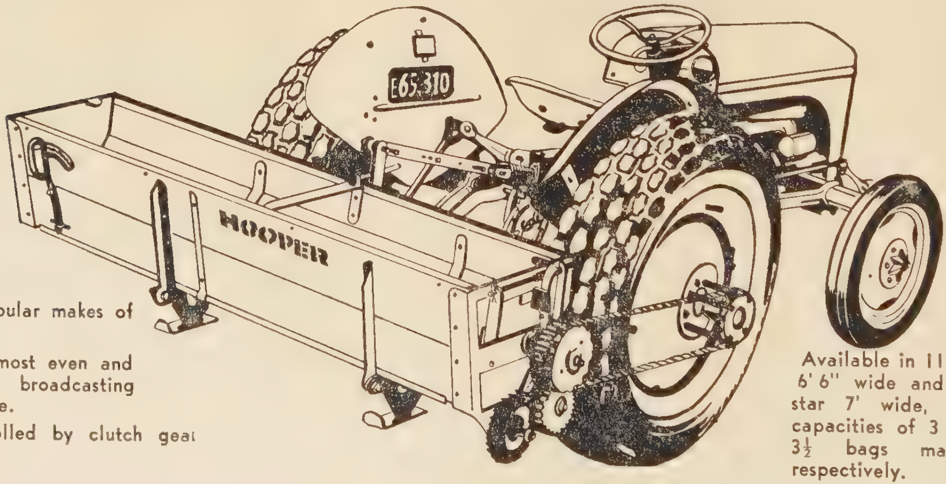

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The Home Garden in November

By A. G. KENNELLY,
Horticultural Instructor,
Department of Agriculture,
Dunedin

HALF-HARDY and tender crops should be sown or planted as soon as the ground is in suitable condition and frost danger is past, but over-enthusiasm should not lead to planting up the garden fully now with half-hardy and hardy crops for summer and autumn so that there is no room for provision of winter supplies. Continuity of supply is very important in the home garden.

Weeds can be kept down most effectively by hoeing, but this should be done regularly because weeds can be controlled best and most easily when small.

SUCCESSIONAL sowings of carrots can be continued or the main crop can be put in. The soil should be in good condition and should contain sufficient moisture, as dryness checks growth and young plants so affected succumb quickly to aphid attack. Later sowings of intermediate or stump-rooted kinds usually result in the production of good-quality roots in late autumn, whereas roots from earlier sowings have by that time usually become large and may be rather coarse.

A close watch should be kept for aphids. Carrot aphids are small, globular, and green or yellowish green and may be wingless or have four transparent wings. They suck the sap and stunt growth so that young plants may wilt in hot weather. The foliage may change to a bronze, bluish, or reddish hue and become distorted. The tiny white specks present are the cast skins of the aphids. Aphids can be controlled by spraying with nicotine sulphate or lindane.

The carrot rust fly is also troublesome in some districts in late November and December. The adult fly is about ⅓ in. long. It has a yellowish head, yellow legs, one pair of wings, and lays its eggs near the crown of the carrot. The larvae or maggots are slender, creamy white, rather rigid, legless, and up to ¼ in. long; they are broad at one end and taper off to a slender head.

After hatching the larvae burrow down and attack the taproot, leaving rusty brown tunnels which at first are only near the surface of the carrot. Young carrots may wilt or die.

Control consists mainly of treating the seed with lindane or dieldrin and, if necessary, regular spraying with either of these substances. Spraying any nearby hedges with DDT to kill the flies is of some value.

Celery

Where conditions are warm enough celery can be set out during November in beds or trenches in soil that has been heavily manured. Beds for self-blanching celery are usually made four to six rows wide with the plants 10 to 12 in. apart each way. In trenches a double row (9 to 12 in. between the two rows) with 9 to 12 in. between the plants is satisfactory. The trench can be up to 12 in. deep.

Double rows can be blanched by drawing the soil high against the ribs (care being taken not to allow any

SOWING AND PLANTING

Sow or Plant When Frost Danger has Passed

Beans (dwarf and runner), cucumbers, marrows, New Zealand spinach, pumpkins, squash, sweet corn, tomatoes, yams. In specially favourable situations: Egg plants, kumaras, melons, okra, peppers.

Successional or Main-crop Sowings

Beetroot, cabbages (summer and pickling), carrots, cauliflowers, Chinese cabbages, celeriac, herbs, kohl rabi, lettuces, onions for salads, parsnips, parsley, radishes, salsify, scorzonera, silver beet, spinach beet, swedes, tampala, turnips.

Plants and Tubers to Set out as Required

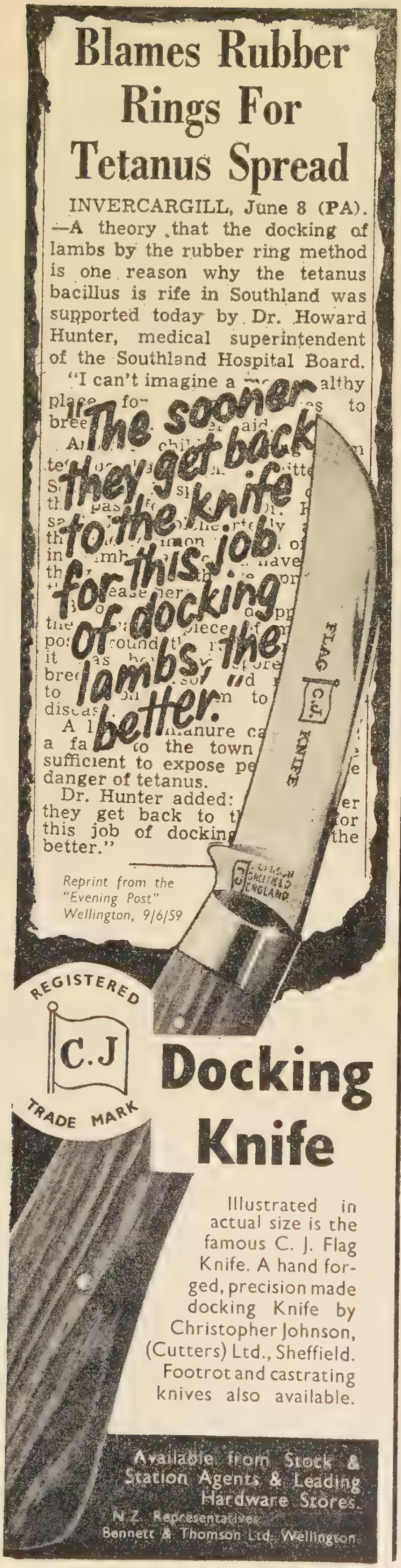
Brussels sprouts (an early planting if necessary), cabbages (summer or autumn), cauliflowers, celery, celeriac, cucumbers, lettuces, potatoes (late planting if desired).

Beetroot and carrots can be transplanted in favourable circumstances.

*Sow for Winter Use as Required

Broccoli, brussels sprouts, cabbages (savoy or winter), kale or borecole.

* Except in favourable far northern districts when later sowing is satisfactory.


"The sooner they get back to the knife for this job of docking of lambs, the better."
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Blames Rubber Rings For Tetanus Spread

INVERCARGILL, June 8 (PA). —A theory that the docking of lambs by the rubber ring method is one reason why the tetanus bacillus is rife in Southland was supported today by Dr. Howard Hunter, medical superintendent of the Southland Hospital Board.

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[illegible]

A l[illegible] manure ca[illegible] a fa[illegible] to the town [illegible] sufficient to expose pe[illegible]e danger of tetanus.

Dr. Hunter added: [illegible]er they get back to t[illegible] [illegible]or this job of docking [illegible] the better."

Reprint from the "Evening Post" Wellington, 9/6/59

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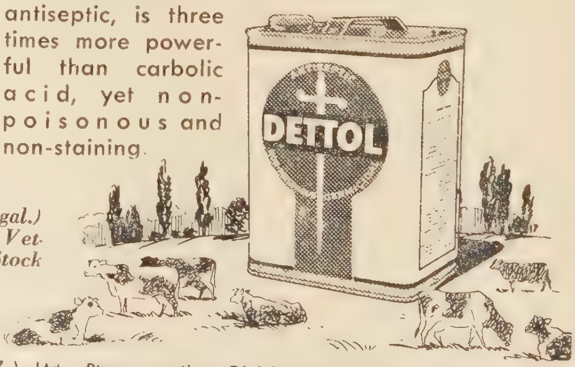

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to get into the centres of the plants) or by wrapping individual plants with stout paper. Beds containing multiple rows are best blanched by placing lengths of 12 in. x 1 in. timber along the outside edges of the bed. Blanching should not begin until the plants are about three weeks from maturity, as otherwise their development will be arrested.

Poultry or farmyard manure is a very suitable manure for celery, but where this is unobtainable or in short supply a mixture of 4 parts of blood and bone, 2 parts of superphosphate, and 1 part of potash by weight can be broadcast over the area at ¼ lb to a square yard and worked into the soil after digging.

Celery should be kept weed free. Where conditions are humid enough for leaf spot to be troublesome celery should be sprayed with zineb, captan, or copper oxychloride at 10- to 14-day intervals. If aphids are present, lindane or nicotine sulphate (1 fl. oz. to 5 gallons of water) should be applied. Celery should not be planted in a part of the garden recently occupied by a carrot crop which has been affected by the carrot rust fly, as the pest is also liable to attack celery.

Celeriac

Celeriac or turnip-rooted celery is a good substitute for celery. The roots, which have a characteristic celery flavour, are mainly used. They may be boiled, used in stews, or sliced and eaten raw as a substitute for celery in salads. Leaf stalks can be used when they have developed well.

Celeriac will usually have to be grown from seed, as it is not as well known as celery and few seedsmen sell plants. There is still time to raise plants from seed. Because it is very hardy, does not require to be blanched, and succeeds on a wide range of rich, moist, and well drained soils, celeriac deserves to be more extensively grown by home gardeners who like the flavour of celery.

Seed is usually sown ¼ to ½ in. deep in rows 15 in. apart when the ground has warmed in spring (late September to early November). Plants can be thinned to or set out 6 to 8 in. apart in rows 18 in. apart, but they should not be set out deeply and should be liberally watered in dry weather. In very dry situations plants should be set out in shallow trenches to facilitate watering.

The soil should be rich so that plants make vigorous, continuous growth. During cultivation side shoots should be removed and the soil dragged away from the bulbous roots, which should be kept trimmed of all suckers, as they tend to cause unshapely development.

In districts which experience repeated severe frosts the roots can be lightly earthed up in autumn for protection, but lifting and storing are unnecessary except in heavy, poorly drained soil in exposed situations.

Varieties include Celeriac and Giant Smooth Prague.

Cucumbers, Pumpkins, Squash, Marrows, and Melons

The culture and soil requirements of cucumbers, pumpkins, squash, marrows, and melons are similar, though melons need warmer conditions than the others. None of these plants should be sown in the open to be above ground before frost danger is past. Moreover, the ground must have warmed sufficiently and not be too wet or the seed is liable to rot. The plants thrive in a wide range of soils from sandy to moderately heavy provided there is an assured supply of moisture (preferably held in the soil) and plenty of organic matter.

Well drained, light, warm, aerated soils are best for early crops, but for main crops heavier soils usually give a higher yield over a longer period. Organic matter can be increased by digging in a green crop, but better results are obtained, particularly in colder districts, if 1 cu. ft. of soil is removed at intervals of 2 to 3 ft and the holes, except for the top 3 or 4 in, are filled with partly rotted, fermenting stable manure and then filled up with soil.

Seed can be sown in the soil placed on top or, preferably, at the edge of the manure. Rows of plants should be at least 4 ft apart. This is known as the hill system of sowing. The ground should if possible be level after sowing to facilitate any necessary watering.

Apart from watering and weed control established plants should need very little attention. With trailing varieties it may be necessary to pinch out the ends of leaders when they are about 18 in. long to encourage the development of laterals. Plants can be trained by pegging the runners with sticks.

The fruit of marrows should be cut when young, preferably before the skin hardens to the extent that it cannot be broken easily by the thumbnail; 10 to 12 in. is a good size. As marrows increase in size their flavour usually is reduced and the seeds increase in size. In favourable seasons, too, early cutting of the fruit induces more to develop. It is therefore inadvisable to allow fruit to reach full maturity unless very large specimens are wanted or fruit is to be stored for winter.

Butternut Squash

A small, pear-shaped bush variety of squash called Butternut is becoming more widely known. It has been grown in the U.S.A. for many years and is now produced commercially in some areas of New Zealand. The fruits, which are up to 1 ft long, have a sweet flavour and the necks are solid flesh. The small seed cavities are in the lower, bowl-shaped ends. The variety keeps quite well if stored under good conditions.

Lettuces

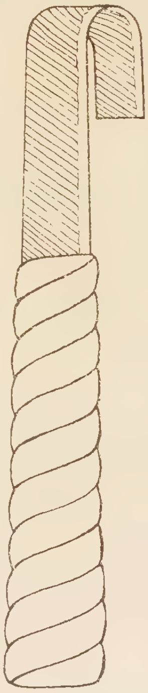
Lettuces cannot be grown successfully in dry conditions. If the soil is aerated, well drained and cultivated, and rich in humus, the crop responds well to watering, provided the soil does not set hard afterward. Crisp, sweet, and tender heads can be produced only by quick growth, which may usually be induced in poorly manured soil by organic liquid manure or by liquid manure made from nitrate of soda or sulphate of ammonia at 1 to 2 oz to 4 gallons of water.

In the hotter or drier districts at this time of year it is preferable to sow the seeds thinly (¼ in. deep in rows 12 in. apart) and later to thin the plants to 9 in. apart in the rows rather than to transplant them. The rows should be watered after thinning to settle the soil back round the plants that are left, as otherwise they may receive a check which may later result in premature seed development.

Varieties are available to suit various climatic conditions in New Zealand. In the warmer districts varieties such as Great Lakes, Imperial 847, or New York 515 (Webbs Wonderful) are especially suitable.

Onions

Weed control is particularly important in the production of onions. Weeds not only use available plant food and so cause a reduction in the crop, but when conditions are damp they tend to create an environment unfavourable to the ripening of the bulbs. Diseases such as mildew and to some extent neck rot are also liable to be more troublesome. A good growth of weeds also provides a congenial environment for many insect pests.



Weeds between the rows can readily be destroyed in hot weather with a sharp hoe. Between the plants weeds must be pulled by hand or they can be removed with a bent knife blade or piece of flat steel sharpened as a knife and bent as illustrated at left.

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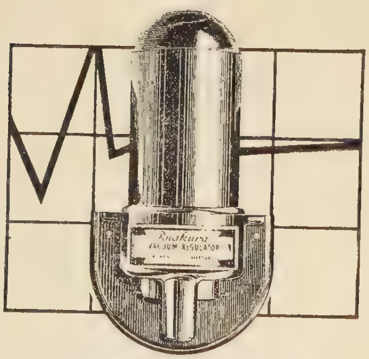

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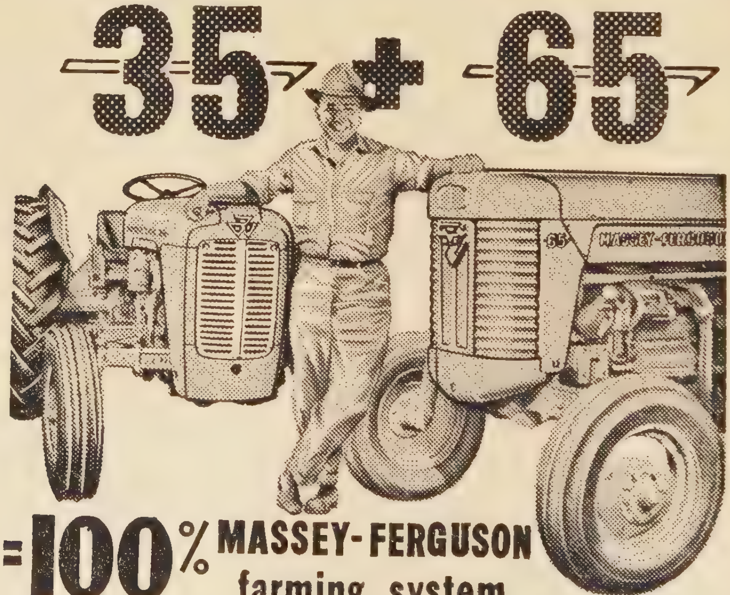

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If the crop is attacked by pests such as thrips, plants should be sprayed with DDT, lindane, or malathion. Where mildew is present the onions should be sprayed with copper oxychloride or zineb.

Sweet Corn

Sweet corn is not a hardy vegetable. It thrives in warm, sunny conditions, and within limits the higher the temperature is and the more sunlight it receives the more likely it is to succeed. It can be grown in most districts in New Zealand, as it is less sensitive to cold than either the tomato or the snap bean, but it is not much grown in gardens in far southern districts.

Seed should be sown 1 to 2 in. deep. If planted in rows, plants should be 12 in. apart and the rows 36 in. apart; clumps should be 36 in. apart. Though it is usually advisable to sow about seven or eight seeds at each clump to allow for failures, only four or five of the strongest plants should be left after they reach a height of about 2 in. The number of seeds per ounce varies from about 100 to 230 according to variety.

Sweet corn matures in about 70 to 100 days and seed can be sown successionally.

Sweet corn is not specially sensitive to drought and usually bears earlier on light, sandy, or peaty soils.

Suckers often develop at the base of the plant during autumn and home gardeners sometimes remove them in an effort to increase the size and encourage early development of the cobs. However, usually the practice is more likely to result in loss than gain, as the removal of large suckers results in loss of plant tissue which is capable of converting plant nutrients into substances which go to the development of the cobs. It may also result in serious plant damage.

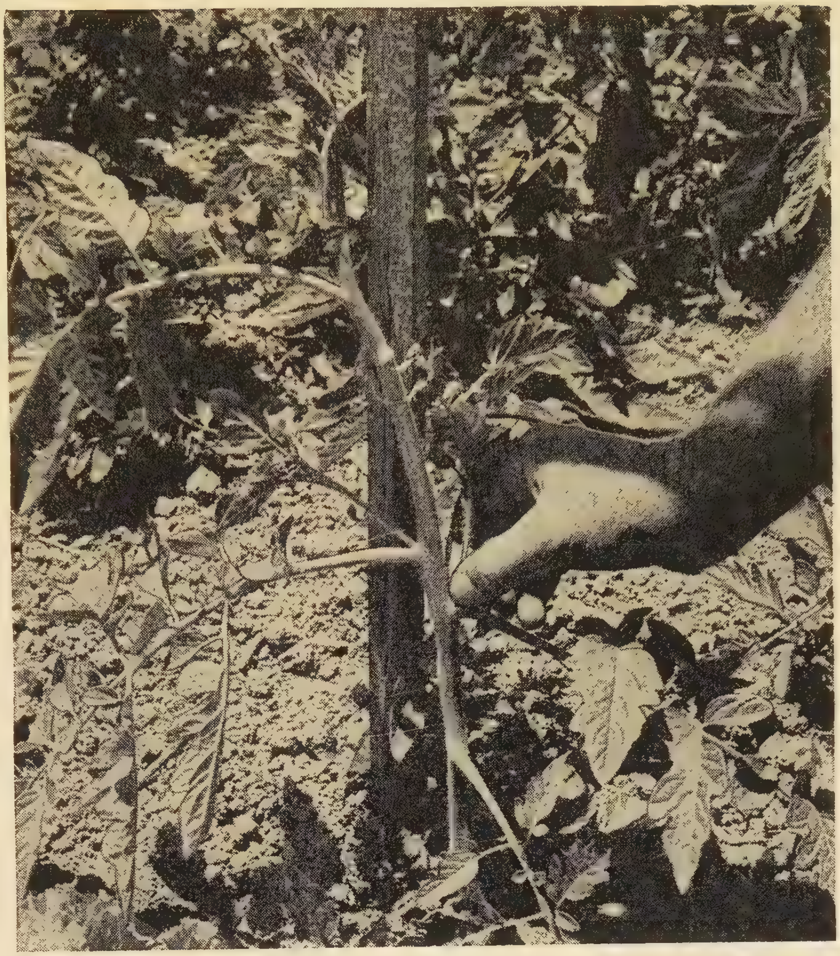
Kumaras

Kumaras are usually propagated by rooted shoots or slips which can be purchased from seedsmen, usually from about mid October onward in areas suited to the culture of the plant.

The soil for kumaras should be of a type that warms readily, and light or sandy loams are usually preferred. Organic manure applied to a previous crop gives most satisfactory results and in most soils it should be supplemented with a dressing of bone meal or superphosphate, as trials indicate that kumaras need a good deal of phosphate, though the need for potash seems to depend more on soil type. Very little nitrogen is usually required and an excess promotes top growth at the expense of tubers. As roots are very sensitive, fertiliser should be well worked along the rows a week or two before planting.

Planting can be done on the flat, but where there is no danger of soil drying out plants are usually set out on broad, low ridges, which warm quickly and facilitate digging. Care should be taken that the rooted shoots do not dry out between lifting and planting. If necessary, they should be puddled in thick, muddy water.

In the home garden slips should be set out 16 in. apart on the flattened tops of low ridges 24 in. apart. Plants, which should be set about the same depth as they grew in the propagating bed, should be watered if conditions are dry. Apart from weed control and the repair of broken ridges, cultivation is unnecessary, though vines are usually lifted occasionally to prevent their rooting, as such rooting appears to favour leaf rather than tuber development.


[*Sparrow*

Removal of side shoots from tall growing tomatoes (see text below).

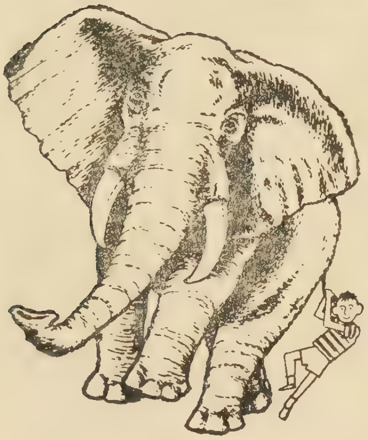
Tomatoes

In most districts tomato plants have now been set out. The young plants should be watered moderately until they are well established and they should be watched for infestation with insect pests or infection with disease. Lindane spray controls aphids and caterpillars. DDT controls most active insects such as caterpillars and is longer lasting than lindane.

Side shoots are best removed while they are small, but to reduce the likelihood of transmitting virus disease on the fingers, side shoots should be grasped between the thumb and forefinger and bent so that they snap cleanly without leaving stubs in the joints of the leaf branches. Fingers should not touch any other part of the plant except side shoots before their removal. Plants with malformation or mottling of the leaves should be destroyed, as they may be infected with virus.

Where late blight is liable to be troublesome plants can be sprayed with a copper spray or with zineb. The latter is also effective in controlling the disease leaf mould.

What's holding it back?



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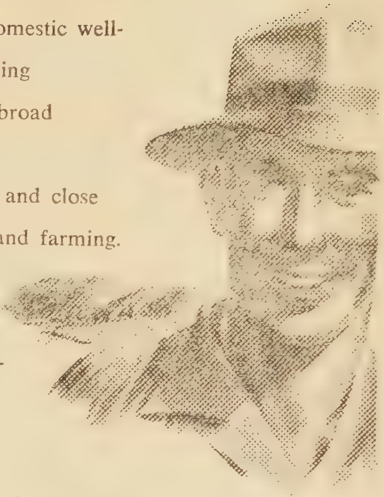

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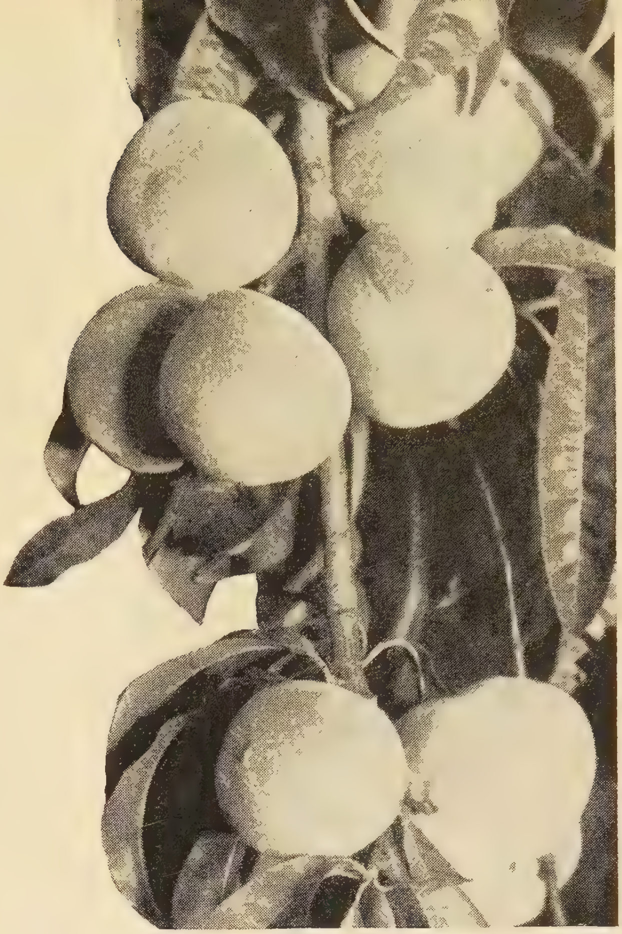
Hormone Application to Apricots and Peaches

By W. S. KEMP, Horticultural Instructor, Department of Agriculture, Alexandra, and D. W. WILSON, Horticultural Instructor, Department of Agriculture, Roxburgh

THOUGH synthetic growth regulators or hormones have been developed for a relatively short time only, their use has already been firmly established in agriculture and horticulture. In fruitgrowing they are now extensively used for thinning apples and for the prevention of preharvest drop in apples, pears, and citrus fruits. More recently it was found that these same growth regulators had economic possibilities in hastening maturity, increasing fruit size, and reducing preharvest drop in stone fruits, particularly apricots. Several articles have already been published with particular reference to their application to apricots.



[National Publicity

OF the hormones used to date 2,4,5-T (2,4,5-trichlorophenoxy acetic acid) has shown most promise, though in certain aspects 2,4,5-TP (2,4,5-trichlorophenoxy propionic acid) shows possibilities. At present the triethanolamine salt is considered the most suitable formulation of these materials for use on stone fruits.

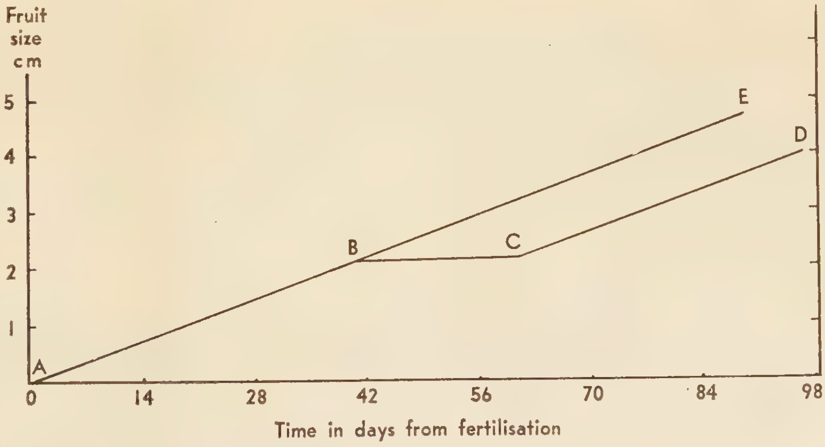
The following account is based on five years' experimental work and observations in New Zealand, as well as on reports on similar work in California and Australia.

Experiments have been carried out on the main apricot varieties, Newcastle, Oullin's Early Peach, Roxburgh Red, Dundonald, and Moorpark, to hasten maturity and increase fruit size, and on Oullin's Early Peach, Roxburgh Red, and Trevatt to reduce preharvest fruit drop. On peaches the main work has been with the Mayflower variety, though others, including Brigg's Red May, Hale's Early Wiggins, and Peregrine, have received attention, particularly on aspects of hastened maturity and increased fruit size.

APRICOTS

Time of Hormone Application

Fruit growth in all stone fruits from the time of fertilisation to the beginning of stone hardening is by cell division. During stone hardening growth virtually ceases. Following stone hardening, though there is some cell division, fruit growth is mainly by cell enlargement (see diagram below). The slowing down of fruit growth during stone hardening is claimed to be the result of a low level of auxin (natural plant hormone) during this period. Theoretically, the application of 2,4,5-T at the beginning of stone hardening offsets this naturally low auxin level and permits growth to continue unchecked. The fruit therefore matures earlier and is larger. It is obvious that for maximum results the accurate timing of 2,4,5-T



Effect of hormone application on fruit growth of apricots and peaches. Curve ABCD shows normal growth development, AB growth by cell division from fertilisation to beginning of stone hardening, BC virtual cessation of growth during stone hardening, and CD fruit size increase mainly by cell enlargement from completion of stone hardening to harvest. The application of 2,4,5-T at B induces fruit growth during stone hardening to give the growth curve ABE.

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application is essential, for once stone hardening has begun and fruit growth rate slowed down, the number of cells capable of enlargement after stone hardening are fewer.

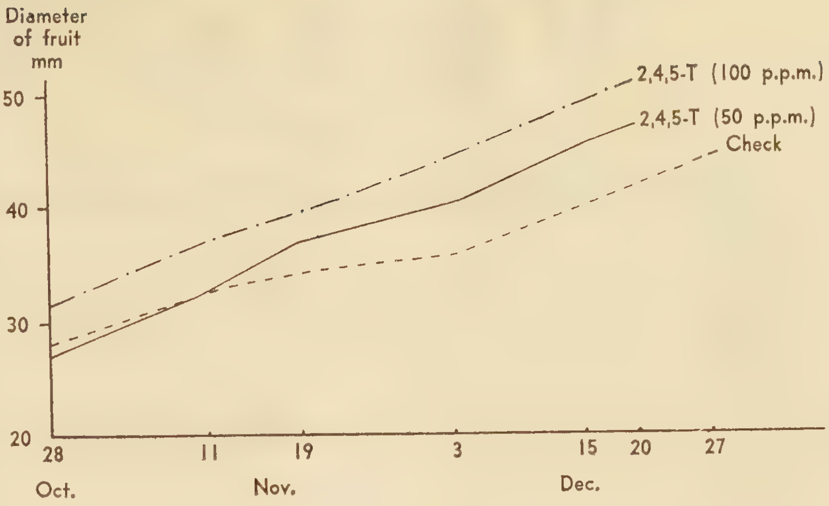
The beginning of stone hardening in apricots varies between varieties and from season to season, but is about 40 to 50 days after full bloom. It is best determined by cutting with a sharp knife through the apex end of the more advanced fruits at right angles to the suture. When a definite resistance to the knife is noted the spray should be applied. American work indicates, and local observations confirm, that at this stage the endosperm tissue, which develops at the apex end of the undeveloped kernel, is 1 to 2 millimetres in length. Endosperm tissue is firm, milky white, and readily discernible from the clear, jelly-like substance which at this stage occupies the greater part of the kernel area.

Thinning before spray application is very desirable, particularly with very heavy crops, as this obviates the trees carrying an excessive number of fruits when foliage efficiency is most impaired. Trees carrying very light crops should never be sprayed.

As 2,4,5-T does not appear to be translocated within the tree, good coverage is essential for maximum results, but excessive run-off should be avoided.

Rates of Application

The optimum spray concentration depends on variety, tree age, vigour, and crop. The younger the tree, the greater the vigour, or the lighter the crop is the lower should be the concentration used, unless the material is specifically applied to reduce vigour. Though varieties differ in their susceptibility to damage, generally the later a variety matures, the lower the concentration that is required. On Newcastle rates of up to 100 parts per million (p.p.m.) can be safely used, whereas on Moorpark concentrations should never be greater than 50 p.p.m. If the material is applied specifically to reduce preharvest drop, 25 p.p.m. usually suffices. Present indications are that at comparable rates 2,4,5-TP is more damaging than 2,4,5-T and until further work is carried out growers should not use the former stronger than 20 p.p.m. Trees should not be sprayed if rain is likely to occur shortly after application. However, where rain sufficient to cause appreciable run-off is experienced within 24 hours of application, the spray should be re-applied in accordance with the following tentative recommendations. Observations indicate that after 24 hours rain does not markedly reduce spray efficacy.



Growth curves of unsprayed (check) Newcastle apricots and those sprayed on 28 October 1954 with 50 and 100 parts per million concentrations of the triethanolamine salt of 2,4,5-T at Earnscleugh, Central Otago.

RESPRAYING STRENGTH NEEDED IF RAIN FALLS

If rain after original spraying falls	Respray at
Within 4 hours ..	¾ to full concentration
After 4 hours, up to 8 hours	½ to ¾ concentration
After 8 hours, up to 24 hours	½ concentration
After 24 hours ..	Do not respray

Results

A summary is given here of the results of detailed experiments and observational trials over five years.

Variety	Maturity hastened	Increase in fruit size
	days	per cent
Newcastle	7-10	10-35
Oullin's Early Peach	5-7	10-15
Roxburgh Red ..	2-10	25-30
Dundonald ..	7-10	30-50
Tilton	2-3	15-20
Moorpark	2-7	10-30

Though fruit size is significantly increased, particularly in varieties such as Newcastle, Dundonald, and Roxburgh Red, generally fruit size has not been greatly increased over that of comparable unsprayed trees when comparisons are made at the same stage of maturity. It is in advanced maturity that the greatest responses have been obtained (see diagram above).

Fruit Drop

Though experiments in New Zealand laid down solely to reduce preharvest drop have not yielded statistically significant results, marked reductions in preharvest fruit drop have resulted in observational trials where 2,4,5-T was applied for hastening maturity and increasing fruit size. Overseas work substantiates this aspect of hormone application. While it is apparent that the period of application for reducing preharvest drop is less critical than that for hastening maturity, etc., application must be before stone hardening is complete.

Preharvest fruit drop is often the result of near-damaging frosts not quite severe enough to cause apparent damage at the time. It can also result, however, under poor growing conditions such as comparatively low seasonal temperatures; heavy, wet soils; comparatively excessive vigour, and/or light crops. Under all these conditions hormone application has appreciably reduced preharvest drop. The main varieties susceptible to preharvest fruit drop are Oullin's Early Peach, Roxburgh Red, Tilton, and Trevatt.

Other Fruit Effects

Colour

The application of 2,4,5-T at stone hardening appreciably increases blush colour on those varieties on which it is characteristic and in some instances has induced blush colour on varieties on which it is not usually characteristic. Ground colour is also enhanced and is more uniform. Though the increase in colour resulting from hormone application tends to some extent to give a false impression of hastened maturity, fruit colour in relation to firmness is a main sales factor in apricots, so that for all practical purposes this masked effect can be considered as hastened maturity.

Flavour and Juice Content

Where the triethanolamine salt of 2,4,5-T has been used at reasonable

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concentrations no differences in fruit flavour and juice content have been detected.

Fruit Cracking

At high concentrations hormone application can cause severe cracking along the suture, thereby reducing the market value of the fruit. In most of the experiments in New Zealand typical hormone cracking has not resulted except when the hormone has been applied to very vigorous trees or trees with light crops. Though rain-type cracking has occurred in several trials on sprayed trees only, in all cases it could be attributed to rain in relation to maturity hastened by the hormone. There is no positive evidence, but it does appear that sprayed fruit, particularly the Moorpark variety, is slightly more susceptible to rain cracking.

Tree Effects

Foliage damage varies from variety to variety and consists mainly of foliage flagging for a few days after hormone application, after which the only evidence of application is the tip burning of some of the more vigorous shoots and, on others, typical hormone leaf distortion on those parts of growths that were young and soft at the time of application. The time of hormone application coincides with the cessation of the first growth flush, and on wood that produces the majority of the fruit buds for the following year hormone application causes foliage flagging only. The wood that can be severely affected is removed during the winter pruning, so the damage is of no consequence. Such damage can be likened to summer pruning to promote fruit bud development.

Fruit bud initiation is not detrimentally affected by hormone application; in fact, in some varieties, particularly Newcastle, heavier bud initiation has resulted. On Newcastle application tends to induce more regular cropping.

To date no detrimental tree effects have been observed from continued application of 2,4,5-T and trees that have been sprayed for five consecutive seasons show no ill effects.

Roxburgh Red appears to be the least susceptible to foliage damage, possibly partly because of the pruning method used for this variety, and Moorpark the most susceptible to foliage and growth damage.

Economics of Hormone Application

The greatest economic advantages from hormone application result on the main early variety, Newcastle, because:

(a) This variety matures between Christmas and New Year, when marketing is difficult and demand less keen. Hastened maturity ensures that the bulk of the fruit is marketed in the pre-Christmas period, when apricots are in very keen demand.

(b) Increased size results in heavier crops of a more preferred size which is easier to harvest and pack.

(c) Increased blush and improved ground colour make the fruit more attractive.

On other varieties the economic value of hormone application is not as great as on Newcastle, but is nevertheless important. Application to the Dundonald variety, for example, enables a characteristically small variety to be grown to reasonable size. On Roxburgh Red it reduces preharvest fruit drop, thereby substantially increasing crops. In addition, the harvesting season of a variety can be extended several days by spraying part of a block only.

The advantages that result to the apricot industry generally, from hormone application are many, provided the correct concentrations are used. In addition to the advantages listed above it has the overall effect of not only spreading the harvesting season of this fruit, but the marketing season as well. Cool storage can only extend the selling period at the end of the season, but fruit quality often suffers. With 2,4,5-T, however, the season can be extended by maturing fruit earlier and, if the hormone is used at the correct concentrations, without detrimentally affecting fruit quality or appearance.

Recommendations

Until further work has been carried out with 2,4,5-TP and other formulations of 2,4,5-T, growers should use only the triethanolamine salt of 2,4,5-T according to variety and purpose as follows:

	For preventing preharvest drop p.p.m.	For hastening maturity and increasing fruit size p.p.m.
Newcastle ..	—	50-100
Dundonald ..	—	50-75
Roxburgh Red ..	25	40-50
Tilton	25	40-50
Moorpark ..	25	25-50
Trevatt ..	25	25-50

In addition the following points should be considered if optimum results are to be expected.

(a) Only mature trees, not excessively vigorous, should be sprayed.

(b) Trees should carry relatively heavy crops to avoid the possibility of hormone-induced suture cracking or of an increase in rain-type cracking.

(c) Trees should be thinned before spray application, particularly if crops are very heavy. On all varieties, however, with the exception of Newcastle and Dundonald, thinning should not be too severe, as detrimental effects such as cracking and coarse fruit may result. Large, coarse fruit is to be avoided and severity of thinning should be regulated accordingly.

Note: On medium crop trees hormone application is not a substitute for thinning.

(d) Time of spray application should be accurately determined by the tests described under the heading "Time of Hormone Application".

If preharvest fruit drop is a problem and increased fruit size and hastened maturity are not desired, a concentration of 25 p.p.m. should be used.

Hormone application can cause a definite vigour reduction in excessively vigorous trees. As in one instance, however, three-year-old trees were almost killed by 50 p.p.m., it would appear that for such a purpose its application should be confined to mature trees, and even on these detrimental fruit effects must be expected.

PEACHES

Work on peaches has not yet reached a point where any firm recommendation can be made for commercial application. As with apricots, the greatest benefit to the grower would probably result from treatment of early-maturing varieties, though this could vary with individual growers. However, trials do indicate that a definite increase in blush colour, some hastening of maturity, and an increase in fruit size can be obtained from hormone application. Preharvest drop is not a major problem with varieties commonly grown in New Zealand. Overseas work, however, indicates that it can be effectively used where this is a problem.

Unlike apricots, stone hardening of peaches does not appear to take place over a clearly defined period. Californian work suggests that 2,4,5-T should be applied 40 days before harvest and local trials tend to confirm this. However, as harvesting varies considerably from season to season, depending on the weather, some more readily determinable optimum time of application would be preferable.

The triethanolamine salts of both 2,4,5-T and 2,4,5-TP have been experimented with and present indications are that there is greater likelihood of a response from 2,4,5-TP. With 2,4,5-T at 25 and 50 p.p.m. no detrimental effects on foliage have been observed. At 20 p.p.m. 2,4,5-TP showed no damage, but at 40 p.p.m. it caused some necrotic leaf spotting and the burning back of some terminals on soft annual growth.

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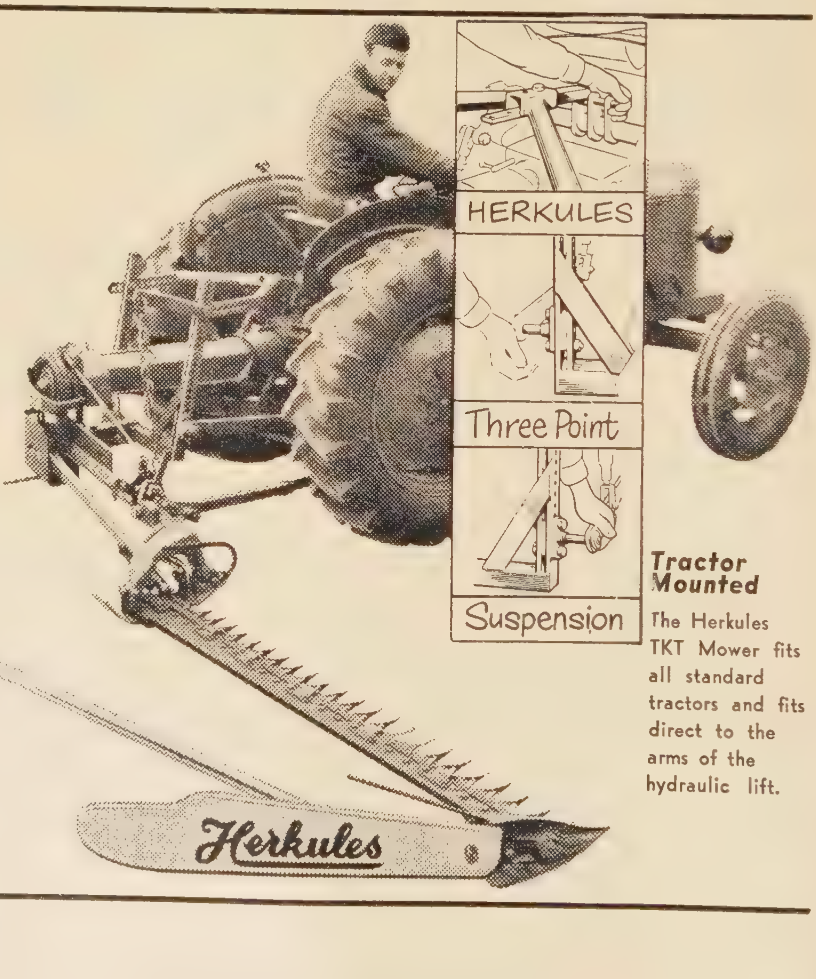
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response from the 2,4,5-TP. Fruit size was not increased to any marked extent, but in this respect 2,4,5-TP was the more effective (with an increase of about 10 per cent). In addition both materials significantly increased blush colour and improved ground colour. Here again 2,4,5-TP was more effective.

On some varieties ripening was uneven on individual fruits, the flesh near the suture showing a greater tendency to mature before the rest of the fruit. Some hormone applications affected fruit by slightly malforming the suture area, giving the fruit a more elliptical shape. In one or two instances fruits were slightly elongated and inclined to be pointed at the apex end. In most varieties tested the effects on fruit shape were not sufficiently obvious to affect market value.

Hormone application did not affect juice content, but in some cases, more especially where 2,4,5-TP was used, there was some effect on flavour, but not enough to be generally noticeable.

Present indications are that hormone application is likely to produce best results on round, white-fleshed dessert peaches rather than on the more elongated and yellow-fleshed varieties.

Hormone application to peaches for hastening maturity and increasing fruit size is still in the experimental stage and no firm recommendations can be made. In the meantime, however, growers interested would be well advised to use the triethanolamine salt of either 2,4,5-T at 50 p.p.m. or of 2,4,5-TP at 20 to 25 p.p.m., about six weeks before harvest.

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Veterinary Diagnostic Station to be Established at Taieri

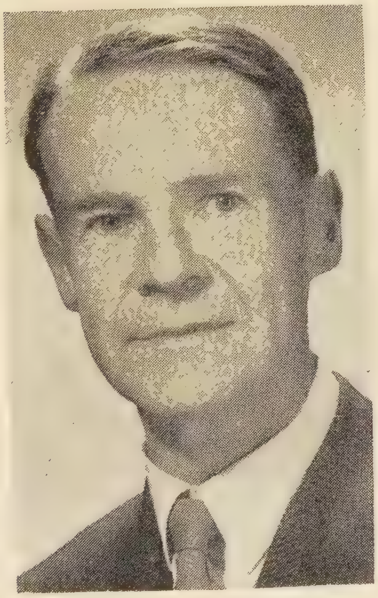
IMMEDIATE plans to establish a veterinary diagnostic station in buildings and on land at Taieri airport and in association with the Department of Agriculture's Invermay Research Station close to Taieri were announced by the Minister of Agriculture, Mr Skinner, in August. Existing buildings and houses to be vacated by the Air Force are available for conversion to laboratories and for occupation by diagnostic station and Invermay staff, and the new station is expected to be ready to operate early in 1960.

"DISCUSSIONS and negotiations with representatives of producer boards, farming organisations, Government departments, and many other bodies concerned in the provision of an adequate and efficient diagnostic service have made it obvious that there could be no further delay in providing a station in the South Island," said Mr Skinner.

Factors in Favour

"A number of factors influenced the decision in favour of Taieri. Availability of buildings to be vacated by the Air Force that could be easily, quickly, and cheaply converted for the needs of the diagnostic station and the availability of former Air Force housing for staff were particularly important and meant that a quick start could be made at Taieri.

Milk Board Chairman



[*Andrew*

MR L. V. PHILLIPS, whose reappointment as chairman of the New Zealand Milk Board was announced by the Minister of Agriculture, Mr Skinner, in August. Mr Phillips is a well known public accountant in Lower Hutt and this will be his second three-year term as chairman of the board.

"The proposed station will also service parts of the South Island furthest from the present service provided by the Wallaceville Animal Research Station, and its location at Taieri will ensure speedy delivery of specimens for diagnosis.

"With the taking over of the requisite buildings and seven acres of land at Taieri by the Department of Agriculture an efficient unit closely integrated with Invermay can be established. The decision means that plans to build laboratory and administrative accommodation at Invermay can now be transferred to Taieri. Presence of the diagnostic station staff, Invermay staff, and staff of the Hydatid Research Unit of the Medical Research Council at the Taieri site will bring all the resultant benefits of close association.

Area Served

"It is intended that the new station shall service mainly all that part of the South Island south of the Waitaki River. After experience with operation of the station at Taieri, the position will be reviewed and consideration given to the desirability of a second South Island station being established, probably at Lincoln. There is a large livestock population in the area to be serviced by the new station and with wider application of new techniques that are enabling more stock to be carried on large areas of Otago and Southland it is expected that there will be rapid increases in numbers of stock there in the immediate future.

"With the establishment of the new station diagnostic work is expected to increase rapidly in the same way as it did in the North Island when a second station was established at Ruakura Animal Research Station.

"It seems obvious that complete coverage of New Zealand as far as Government diagnostic stations are concerned will eventually require two stations in the South Island and a third North Island one at Whangarei," the Minister concluded.

◆◆

By G. C. EVERITT,

Scientific Officer,

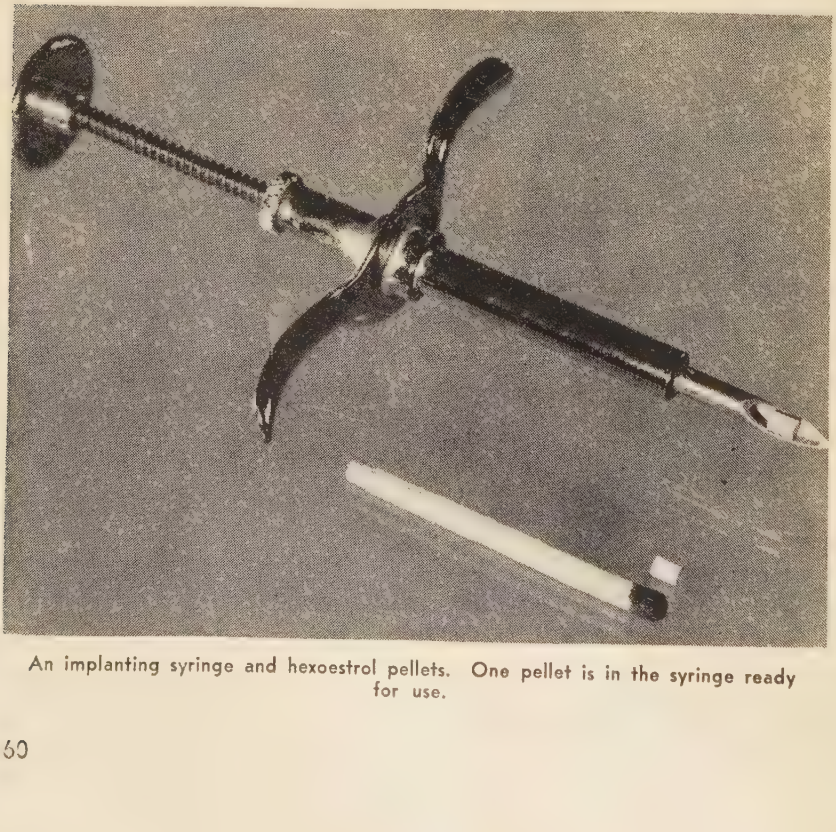
Department of Agriculture Ruakura

Animal Research Station, Hamilton

THE use of sex hormones to increase the rate of production of beef cattle has been studied at Ruakura Animal Research Station and a preliminary report was given in a paper to the Station's Farmers' Conference in 1958. Results of further work reported to the 1959 conference in June last were stated to show that hexoestrol could be a most valuable tool for increasing efficiency of beef production; but it was a treatment about which much had yet to be learnt and the drug should be available for use by farmers only through veterinarians.*

Trials with Hexoestrol for Beef Production

IT is regrettable that beef production is severely penalised by a slow turnover; it takes at least two and a half years to produce an animal suitable for the chiller beef trade. Any economical method, therefore, which will increase this rate of production, but at the same time retain the essential features of meat quality, has much to commend it. One way is to give sex hormones to steers during the final fattening stage of growth. A report of a pilot trial with hexoestrol, a manufactured sex hormone, in fattening beef steers was given to this conference last year. In effect this treatment aims to replace some of the sex hormone in the castrated animal, the source of which was removed at the time of castration.



An implanting syringe and hexoestrol pellets. One pellet is in the syringe ready for use.

GENERALLY, castration prevents the development of the secondary male characteristics; that is, those characters which, while closely associated with the male sex, are not directly concerned with the reproductive processes. The flesh of castrated animals is much improved thereby and they lay down fat more readily. In terms of growth-rate, however, as distinct from rate of maturity, the entire male has a higher rate of gain than the castrate. The sex hormone produced by the testicles is responsible for these and other characteristics.

It is quite understandable, therefore, that in the attempt to replace some of the sex hormone in the castrated animal the amount given is critical, as is the time of replacement, for though stimulation of growth-rate is required, production of the secondary male characters is undesirable.

The results of the small pilot trial described last year encouraged us to carry out a series of larger trials both at Ruakura, where detailed investigations could be made, and on farms in the Waikato area. The latter experiments would provide results from cattle kept under a variety of farm conditions, though, necessarily, such results would be more general.

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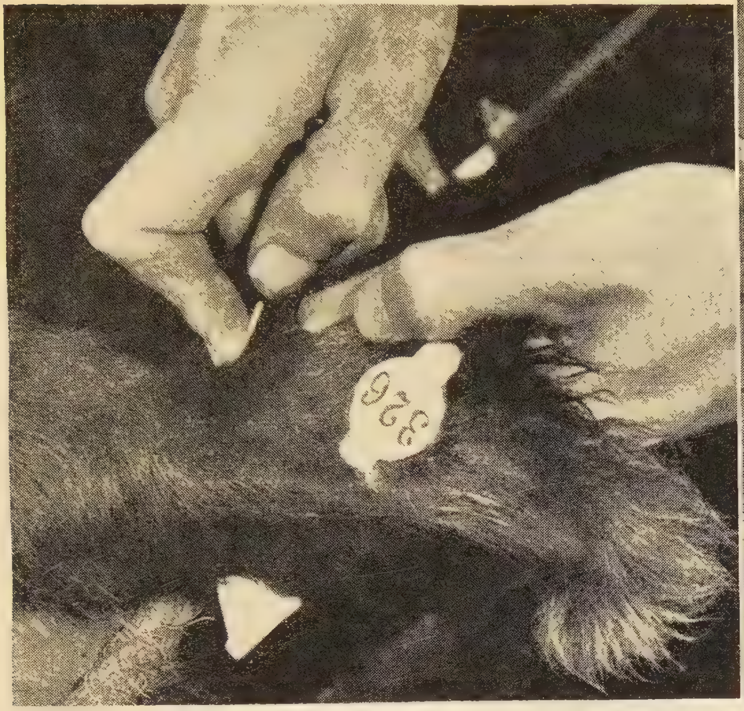
* At the close of discussion on the paper a motion by Mr F. C. Johnstone, deputy chairman of the New Zealand Meat Producers Board, that hexoestrol be used in the meantime only by veterinarians and not by farmers indiscriminately was seconded and carried on the voices of an attendance of about 800.

Adequate restraint of the animal is essential for → correct implantation.

↓ The hormone is implanted in the ear, as there would be a serious danger to consumers of meat if the drug was placed elsewhere.



EXPERIMENTS AT RUAKURA

At Ruakura two groups of Aberdeen Angus steers were available, namely:

(a) Twelve two year olds in fresh store condition, and

(b) Eleven five year olds, previously used on the Hill Station but over-wintered at Ruakura, which were fairly forward in condition.

Six of the two-year-old steers were implanted with 60 mg of hexoestrol on 29 September 1958; the remaining six steers were not treated and acted as controls. The hormone was supplied as four very small pellets, each pellet weighing 15 mg and being about the size of a small match head. The illustration on page 360 shows the size of a pellet of hexoestrol and the instrument used for implanting.

The illustration above right shows how implantation is done where the steer's head is restrained by a head bail, the pellets being implanted under the loose skin at the top and back of the ear.

This illustration is included to emphasise that much of the success of this treatment is dependent on obtaining a good implant and this can be done only when the animal is properly restrained.

Implantation of the five-year-old steers was done on 7 October 1958. It consisted of six pellets, or a total of 90 mg, of hexoestrol. The same method of implantation was used. Five steers were implanted and six were left untreated to act as controls.

All these cattle were run together and given good grazing, without supplementary feed. Live weights were recorded every two weeks.

One of the possible disadvantages of this treatment is that certain defects, mainly of conformation and commonly termed "side effects", may become apparent in the animal. Consequently, the cattle were closely observed throughout the trial. There was a suspicion that the treated steers were more easily excited and this was most noticeable at the time of slaughter. No other side effects were seen, except that the rudimentary teats of the treated cattle became much enlarged.

Slaughter took place in January 1959, 91 days after implantation of the five-year-old steers and 101 days after implantation of the two-year-old steers. There was no indication by eye judgment that treated steers were finished sooner than their controls.

Two-year-old Steers

Table 1 summarises some of the information relating to the two-year-old steers, and for comparison the results of the previous year's pilot trial are included.

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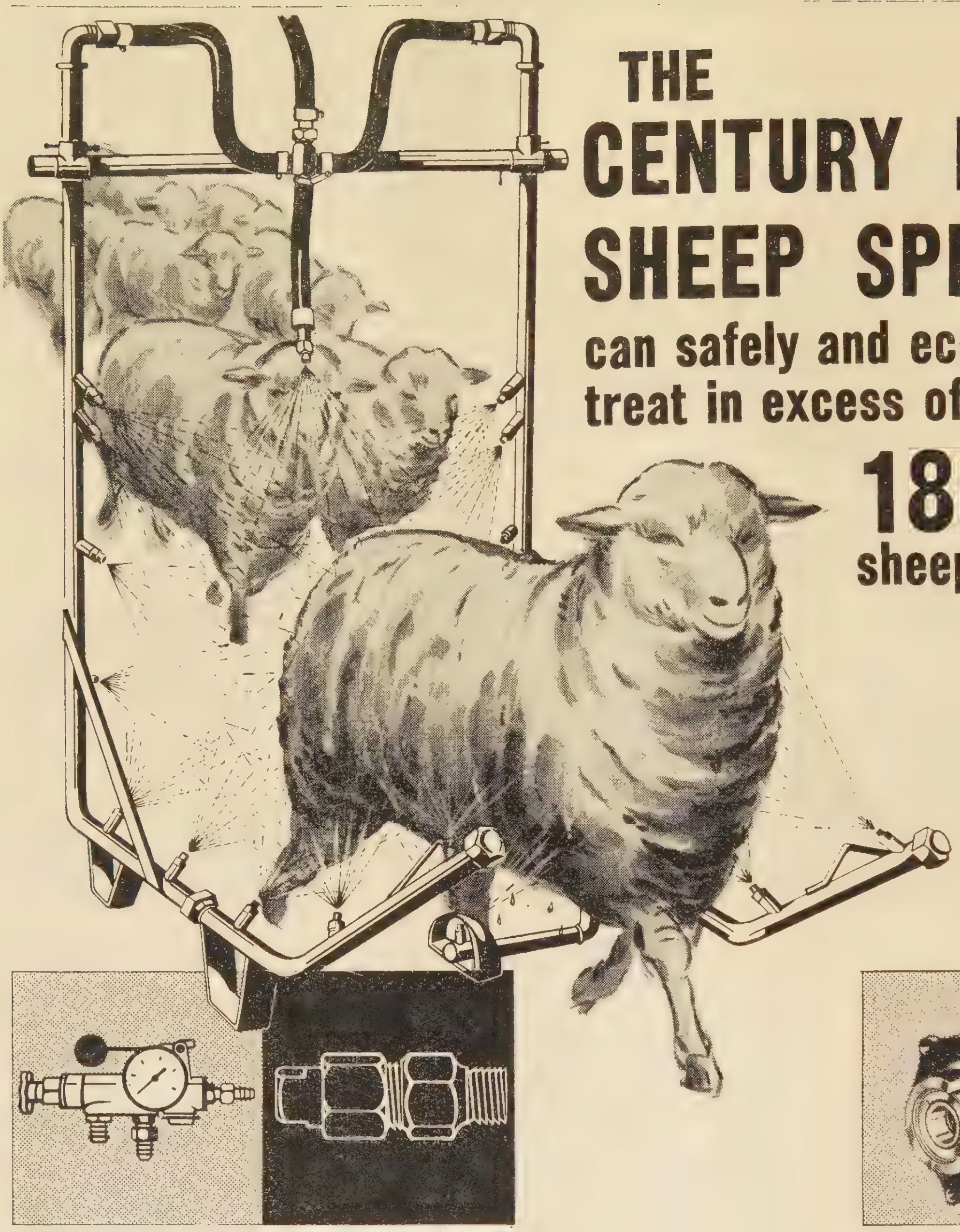

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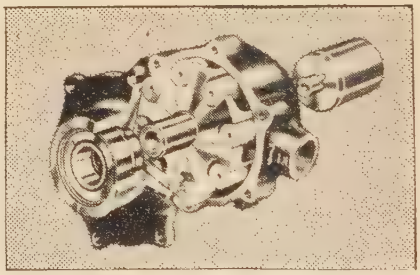

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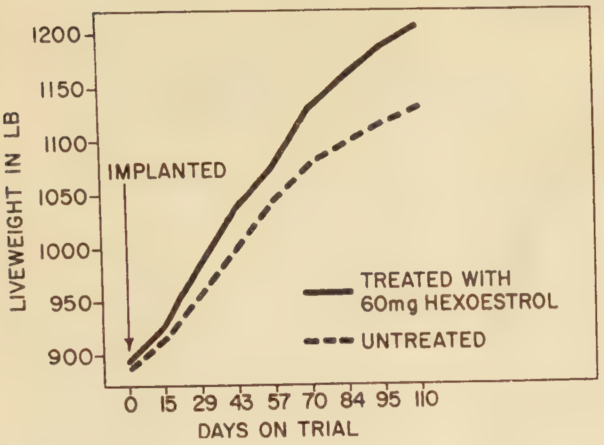
TRIALS WITH HEXOESTROL FOR BEEF PRODUCTION

EFFECT OF HORMONE IMPLANTATION ON LIVEWEIGHT GAIN OF TWO-YEAR-OLD STEERS



EFFECT OF HORMONE IMPLANTATION ON LIVEWEIGHT GAIN OF FIVE-YEAR-OLD STEERS

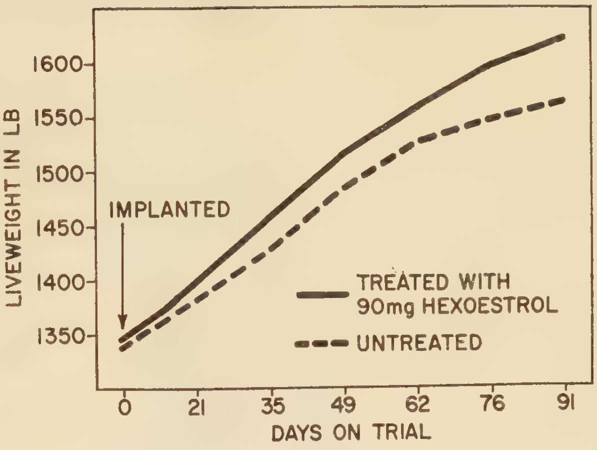


TABLE 1—EFFECT OF HORMONE IMPLANTATION ON LIVE-WEIGHT GAIN OF TWO-YEAR-OLD STEERS

	1957-58		1958-59	
	Control	Treated	Control	Treated
Number of steers	4	4	6	6
Dosage level of hormone (mg)	—	60	—	60
Live weight at start of trial (lb)	950	949	887	893
Number of days on trial	107	107	101	101
Total live-weight gain (lb)	212	307	245	317
Weight increase per day (lb)	1.98	2.87	2.43	3.15
Percentage increase in daily live-weight gain	100	145	100	130

Treated steers added a total of 317 lb live weight or 3.15 lb per day, compared with only 245 lb total live-weight gain or 2.43 lb per day for the controls. This means that the treated steers had an increased daily live-weight gain of 30 per cent. Though the treated steers in the 1957-58 pilot trial had an increased rate of gain of 45 per cent over the controls, the actual gains of both control and treated steers were less than in this year's experiment. Nevertheless, the results from the two trials agree fairly closely.

Five-year-old Steers

Similar information for the five-year-old steers is given in Table 2.

Again there is a close agreement of the results from the two trials. In the 1958-59 trial the treated steers had an increased daily live-weight gain of 24 per cent compared with 28 per cent in the previous year. In overseas trials with this drug results have tended to be inconsistent; in other words, the precise amount of gain cannot be guaranteed any more than can the growth-rates of untreated cattle.

Closer investigation of these live-weight gains has revealed that for both age groups the increased gains of the treated groups were more apparent in the second half of the feeding period. This fact does not agree with a lot of work done overseas where the greatest effect has been in the first six weeks after implantation. This inconsistency in results will have to be checked by future work.

Carcass Quality

With a treatment such as this it is vital that the story should be taken beyond the farm gate; the quality of the product is immensely important. Each carcass was assessed for quality by a system which has been used at Ruakura for many years. Essentially this system consists of allocating marks for certain carcass characteristics which are assessed, mainly, by measurements. Many farmers will know this type of judging from the shows held at various freezing works. Some of these carcass-quality results are given in Tables 3 and 4.

TABLE 2—EFFECT OF HORMONE IMPLANTATION ON LIVE-WEIGHT GAIN OF FIVE-YEAR-OLD STEERS

	1957-58		1958-59	
	Control	Treated	Control	Treated
Number of steers	7	7	6	7
Dosage level of hormone (mg)	—	90	—	90
Live weight at start of trial (lb)	1,221	1,208	1,338	1,345
Number of days on trial	102	88	91	91
Total live-weight gain (lb)	348	378	225	279
Weight increase per day (lb)	3.39	4.35	2.56	3.17
Percentage increase in daily live-weight gain	100	128	100	124

TABLE 3—EFFECT OF HORMONE IMPLANTATION ON CARCASS QUALITY OF TWO-YEAR-OLD STEERS

	Control	Treated
Live weight at slaughter (lb)	1,130	1,211
Carcass weight (lb)	593	621
Dressing out (per cent)	52.48	51.28
Blockiness:		
Measurement (in.)	17.25	17.0
Points (maximum, 20)	7	9
Rib-cover points (maximum, 5)	3	4
Fat-distribution points (maximum, 10)	6	7
Balance of carcass (hinds minus fores:		
Difference in weight (lb)	+13	+13
Points (maximum, 10)	6	5
Weight of kidney and channel fat (lb)	17.6	13.0
Total carcass score	53	53

In Two-year-old Steers

For the two-year-old steers the difference of 81 lb in live weight at slaughter between the two groups was reduced to a difference of 28 lb in carcass weight. This was due to the lower dressing-out percentage, which is the carcass weight expressed as a percentage of the live weight, of the treated steers, and it means that there was a greater production of uneatable products. Treated cattle produced carcasses which were more blocky, with a better cover of meat over the ribs, and with the fat distributed more equably than in the untreated carcasses. This latter point is reflected in the weights of excess fat surrounding, and near to, the kidneys, where the treated carcasses had nearly 5 lb less fat. Today, this factor of fatness, particularly in this region of the body, is a very important selling point.

The best cuts of meat are located in the hind end of the beef carcass, and the heavier the hind end is in relation to the fore end the better; this is known as the balance of the carcass. There was no difference in weight, however, in the balance of the carcass between the two groups. No differ-

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ences were observed in the thickness of the "eye" muscle, which denotes a meaty carcass; in the depth of fat over the "eye" muscle, in marbling of the muscle, or in the colour and texture of muscle and fat. Despite the variations in individual characteristics, both control and treated steers attained the same total carcass score.

In Five-year-old Steers

Information about the five-year-old steers is given in Table 4.

TABLE 4—EFFECT OF HORMONE IMPLANTATION ON CARCASS QUALITY OF FIVE-YEAR-OLD STEERS

	Control	Treated
Live weight at slaughter (lb)	1,563	1,623
Carcass weight (lb)	835	857
Dressing out (per cent)	53.42	52.80
Fullness of meat (depth of "eye" muscle):		
Measurement (mm)	60	63
Points (maximum, 20)	6	7
Fat cover, depth of fat over "eye" muscle:		
Points (maximum, 20)	9	10
Blockiness:		
Measurement (in.)	19	19
Points (maximum)	6	7
Rib-cover points (maximum, 5)	2	3
Balance of carcass (hinds minus fores):		
Difference in weight (lb)	+38	+8
Points (maximum, 10)	3	1
Weight of kidney and channel fat (lb)	24.1	17.4
Total carcass score (maximum, 100)	42	41

Dressing-out percentage of treated five-year-old steers was again slightly lower than that of the control steers, and this meant that a difference of 60 lb in live weight at slaughter was reduced to a difference of 22 lb in carcass weight. No differences were observed in the marbling or in the colour and texture of muscle and fat. Treated steers produced more meaty carcasses, as judged by measurements of the "eye" muscle, and the fat cover over the "eye" muscle earned more marks.

The carcasses of treated steers were more blocky and the rib cover was superior. Because the fore ends of the treated steers were proportionately heavier than the hind ends, only one mark was allowed for this character compared with three marks for the control steers. The weight of excess fat near the kidneys was 6 lb less in the treated animals, and this must be taken into account when considering carcass balance. Total carcass scores of the two groups were very similar.

Effect on Consumer

Finally, the consumer of this meat was considered. Has the treatment any effect on the consumer? To assess if there was any hormone left in the carcass, various parts were subjected to a very sensitive test, and no detectable amount could be found when the drug was given to the animal in the amounts previously stated. This problem has received considerable attention from overseas workers, and it has been calculated that **over 140 lb of meat per day** would have to be eaten to produce any effect.

In this respect it is important to remember that the drug was placed in the ear, a part not consumed, but a serious danger would exist if the drug was implanted anywhere else, for then any hormone unabsorbed at slaughter would be present in large amounts.

Results of Ruakura Experiments

To sum up these Ruakura experiments, it seems that the doses of hexoestrol used have increased live weight by about 60 to 80 lb. Owing to a lower dressing-out percentage this has increased carcass weight by 20 to 30 lb. There has been no significant depreciation of carcass quality from the treatment; indeed, there have been some indications of better quality owing to a more meaty carcass with slightly less fat. These results substantiate those of last year. If it is assumed that beef sells at 120s. per 100 lb, this carcass weight increase is worth about 25s. to 40s. per head. Each 15 mg pellet of hexoestrol costs 3d. and if the initial cost of the implanting instrument (about 35s.) and of labour of implanting and of depreciation of equipment is included, a total cost of about 1s. 6d. per head seems appropriate.

This is quite a rosy picture, but before jumping to conclusions we must examine the results from the field-scale trials.

FIELD TRIALS

The purpose of the field trials was to investigate the effect of various levels of hexoestrol on the live-weight gain and carcass quality of Aberdeen Angus steers kept under a variety of New Zealand grassland farming conditions.

It had been expected that the 60 mg dose of hexoestrol might induce undesirable side effects and there was also some overseas evidence to suggest that lower levels than 60 mg might produce as much, if not more, weight gain in animals. Therefore in these field trials the doses of hexoestrol used were 30 mg (or two pellets) and 45 mg (or three pellets, each of 15 mg).

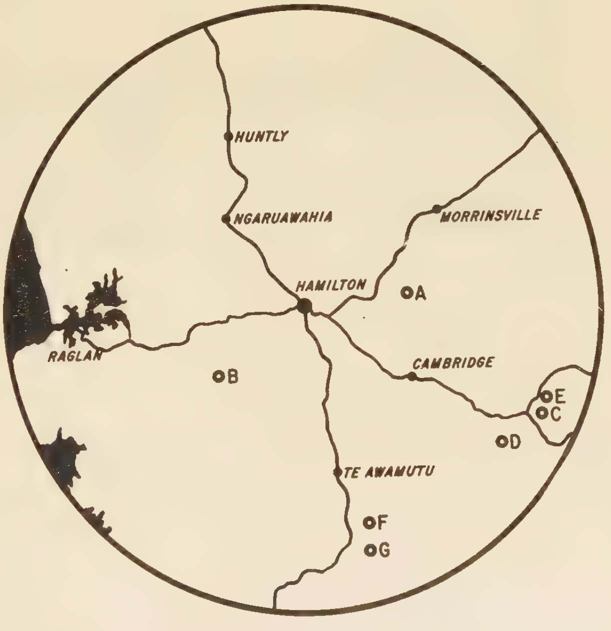
Response to treatment with hexoestrol may vary according to seasonal conditions. The majority of cattle were implanted, therefore, in spring, but a smaller number were also treated in autumn. Only the results from the cattle treated between September and December 1958 are at present available.

Seven farmers cooperated in these trials. All the farms were within a 30-mile radius approximately of Ruakura; their location is shown in the diagram below.

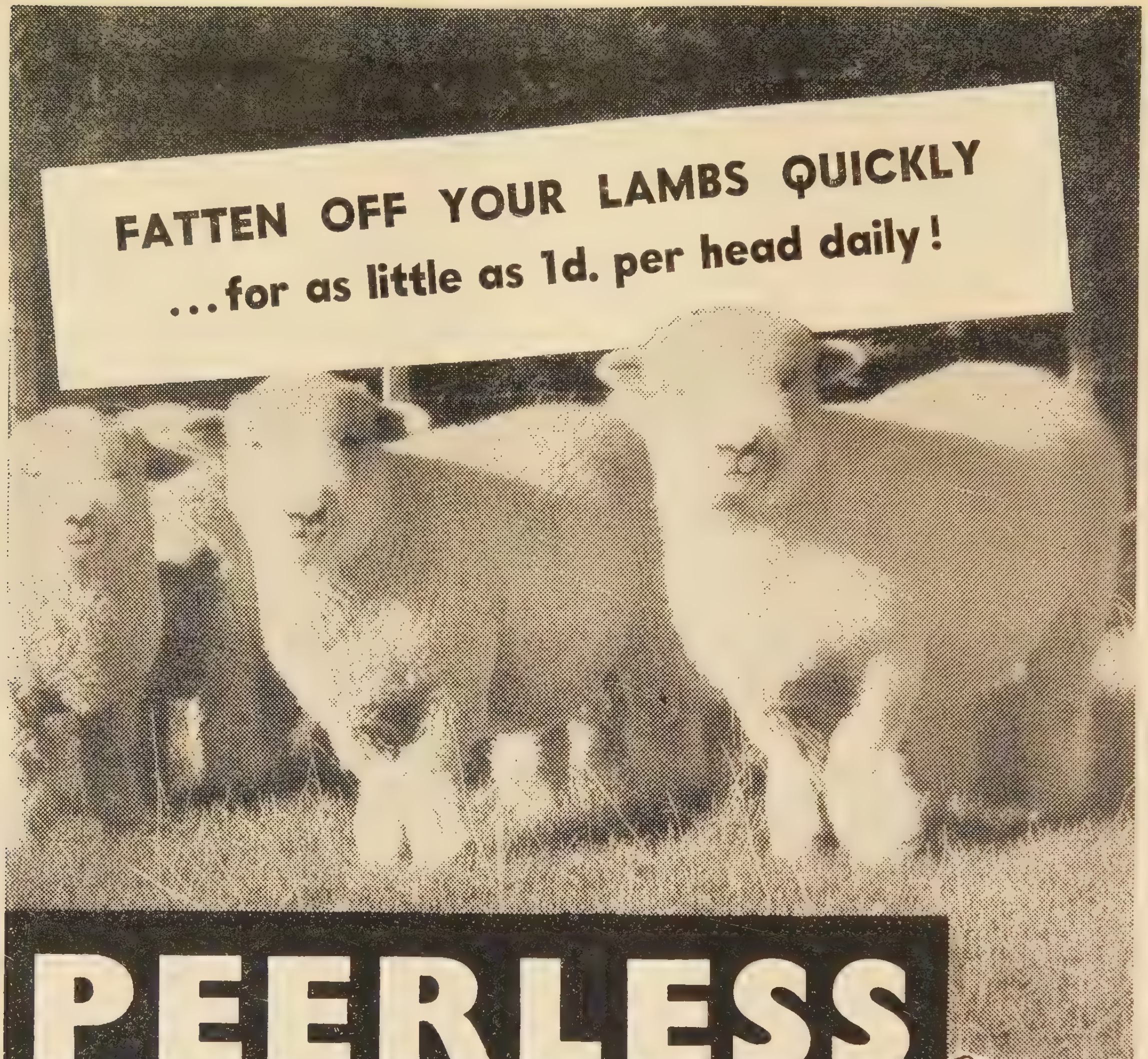
The varied nutritional and management conditions of these seven farms can be considered as a reasonable sample for the Waikato at least.

On each farm the cattle used for the experiment were divided at random into three groups (an untreated or control group, a group treated with 30 mg of hexoestrol, and a group implanted with 45 mg). An ear tag was given to each steer and the drug was implanted in the right ear of the cattle in the treatment groups. Subsequently all the cattle were weighed on a mobile weighing machine. The farmer was asked to feed the cattle well at all times, to retain them for about three months, and to market them through one of the schedule-price meat organisations.

Owing to the serious risk of bruising cattle if they are weighed immediately before slaughter, live weights were obtained only at the time of implantation. The gains made by the cattle on trial were estimated by assuming that at the time of treatment all the cattle would have given a dressing-out percentage of 53. This estimated carcass weight was then



Locations of farms cooperating in field trials with hexoestrol.



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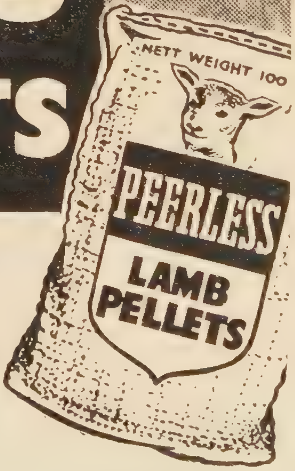

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compared with the carcass weight obtained at slaughter, and the difference taken as the gain made by the animal. It is important to realise that this method gives only an **estimate** of the carcass gains made; the comparison can only be a relative one between groups, and the real or absolute gains of each group may have been rather different.

Two-year-old Steers

A summary of the results of some of the two-year-old cattle in the trial is given in Table 5. As the farm conditions varied greatly, it is necessary to consider each farm separately.

TABLE 5—CARCASS WEIGHT GAINS BY TWO YEAR OLDS IN FIELD SCALE TRIALS WITH HEXOESTROL, 1958-59

	Farm A			Farm B			Farm C			Farm D			Farm E		
Days on trial	118			134			124			133			139		
Treatment (mg of hexoestrol)	—	30	45	—	30	45	—	30	45	—	30	45	—	30	45
Number of steers	9	9	9	8	11	11	12	13	11	10	11	12	8	8	7
Gain in carcass weight (lb)	160	175	200	170	190	195	120	145	145	160	185	165	155	185	165
Percentage increase in carcass gain of treated/control steers	100	109	125	100	112	115	100	121	121	100	116	103	100	119	106
Total carcass score (maximum, 100)	57	59	61	61	58	58	58	57	57	63	62	63	62	60	60

Farm A

The 27 cattle on Farm A were killed 118 days after implantation. The 45 mg dose of hexoestrol added 40 lb in estimated carcass weight, or 25 per cent more than in the untreated steers, while the 30 mg dose added 15 lb or an extra 9 per cent. No side effects were observed, except that some of the 45 mg-treated group produced a dark-cutting meat. Total carcass scores reveal the two treated groups to be slightly superior in overall quality and this was mainly due to the production of more meaty carcasses.

Farm B

On Farm B the cattle were selected for slaughter by the farmer as they became "finished" in condition, and there was some indication that the two treated groups, especially those dosed at the 30 mg level, reached a marketable state sooner than the untreated group. The 45 mg dose gave a slightly increased gain over the 30 mg and both treatments had increased gain of 12 to 15 per cent over the control group. Carcass scores of the two treated groups were the same, 58 marks out of 100, but were three less than those of the untreated steers. It is possible that some of these animals were either implanted when too young or that they were kept on treatment too long. Whatever the cause, the treated carcasses lost a number of marks by being too lean for present requirements.

Farm C

Again there was an indication from the marketing of Farm C cattle that the treated groups were finished slightly before the untreated steers. Increased gains made by the two hexoestrol treatments were the same, each treated group having a 21 per cent increase over the control group. A number of the carcasses from the 45 mg group showed considerable side effects, such as dark-cutting meat and a staggy appearance which produced relatively heavy fore ends and an elevation of the tail head with consequent depression of the loin region. Total carcass scores of the two treated groups were only one mark less, however, than those of the untreated group; the side effects were counteracted mainly by increased muscle content and by a better fat distribution.

Farm D

Farm D stock were slaughtered 133 days after implantation. The 30 mg dose produced the greatest gain, with an increase of 16 per cent over the controls, whereas the 45 mg dose gave only a 3 per cent increase. No side effects were seen in either of the treated groups and the total carcass scores were very similar. Meatiness of the carcasses of the two treated groups was better than that of the controls and fat cover and fat distribution got higher scores.

Farm E

Cattle from Farm E were slaughtered 139 days after beginning of the treatment. The smaller dose of hexoestrol increased carcass gain by 19 per cent compared with 6 per cent for the 45 mg dose. The fore ends of the carcasses of both treated groups were proportionately heavy and there was evidence of dark-cutting meat from the steers treated with 45 mg. Thus the two treated groups had a lower total carcass score than the control group.

Three-year-old Steers

Results for some of the three-year-old cattle in the trial are given in Table 6.

TABLE 6—CARCASS WEIGHT GAINS BY THREE YEAR OLDS IN FIELD SCALE TRIALS WITH HEXOESTROL, 1958-59

	Farm F			Farm G		
Days on trial	97			103		
Treatment (mg of hexoestrol)	—	30	45	—	30	45
Number of steers	10	10	10	7	6	6
Gain in carcass weight (lb)	100	130	135	145	155	145
Percentage increase in carcass gain of treated/control steers ..	100	130	135	100	107	100
Total carcass score (maximum, 100)	53	55	55	—	—	—

Farm F

Ninety-seven days elapsed between implantation and slaughter of cattle from Farm F. The gains of cattle were the lowest of any in the experiment and yet the 30 mg and 45 mg treated groups had increased carcass gains of 30 per cent and 35 per cent respectively over the controls. Fat distribution was definitely superior in the two treated groups and total carcass scores of these two groups were two marks higher than those of the controls. Severe side effects were apparent in the 45 mg group, but were absent in the group which received the smaller dose.

Farm G

On Farm G increase in carcass gain was shown only by the group which received 30 mg; the 45 mg group showed no increase over the control group. Carcass-quality assessments were not obtained for these cattle. The small increased carcass gain from the smaller dose and the absence of an effect from the 45 mg dose were probably due to the rather poor feeding conditions on this farm, but the numbers in each group were also small.

Results of Trials

These field trials with hexoestrol can be summarised as follows: Under good feeding conditions there have been increases in carcass weights from both the 30 mg and 45 mg doses of hexoestrol. These increases have ranged from 10 per cent to 33 per cent over untreated cattle. Some of the responses from 45 mg have been superior to those from 30 mg and some have been inferior. Most important, the 45 mg dose induced in many of the cattle side effects which were not apparent in cattle dosed with 30 mg. Therefore it can be concluded that for two- and three-year-old Aberdeen Angus steers, at least, the smaller dose, 30 mg, is probably the optimum for commercial application. This dose is likely to give as good weight gains as would the larger dose and the possibility of side effects is minimal.

LESSONS OF TRIALS

There is still much to be learnt about the use of sex hormones in meat production, but several interim recommendations can be made in the light of the results described here. The optimum dose of 30 mg of hexoestrol has already been mentioned. Dangers of overdosing can be emphasised again. With excessive doses of hexoestrol growth-rate may be depressed, side effects will appear with consequent deleterious effects on carcass quality, and, in severe cases, there may be blockage of the intestinal and reproductive systems.

Present knowledge allows us to recommend this treatment for steers only; the value of the use of hexoestrol in fattening heifers is problematical and requires more research. Breeding stock of any class is definitely not suitable for hexoestrol implantation.

The age, weight, and condition at which the steers are implanted are important. Firstly, the animal should be in the final fattening stage of growth. For aberdeen Angus steers this means that they will probably be not less than two years old and that they will weigh about 8 cwt live weight or 450 to 500 lb carcass weight. Treatment of relatively young and immature cattle will cause the development of very large bones and little else.

There is only one place to implant the hormone pellets: beneath the loose skin at the back of the ear. To do this simple operation efficiently a good head-bail is essential.

Placing the drug in any other part of the animal but the ear is potentially extremely dangerous to the consumer.

Cattle must be well fed from the time of implantation to the time of slaughter; otherwise the effect may not be apparent. The treatment period should last approximately 100 days. We do not know precisely what happens if these two rules are not observed, but probably there would be little or no useful effect from the treatment; trials have been started recently to investigate these two points.

Finally, cattle treated with sex hormones must be handled much more efficiently and quietly than normal stock. The treatment makes the animal more susceptible to stress and excitement of any description. An excited animal will not make efficient weight gains and there may be detrimental effects on carcass quality.

An important question not yet adequately answered is whether the treatment has any effect on subsequent grazing stock through hormonal activity in the excrement, though recent work in Britain indicates that any residual hormone in the excreta is fairly quickly made inactive by certain soil micro-organisms. This danger, of course, is more real when animals are given hormones by mouth. Research work will continue on this problem.

At the beginning of this article it was emphasised that this treatment is a scientific attempt to restore the sex hormone balance of the castrated animal to a prescribed level, and the treatment should be considered in this light. It cannot replace, in any way, good animal husbandry.

Results have shown that intelligent use of hexoestrol can prove most valuable for increasing the efficiency of beef production. But because very little is known of the precise mode of action of the treatment and because of the long list of possible dangers the treatment is obviously open to the widest abuse.

For these reasons it is my personal, strong recommendation that this drug and others like it should not be readily available to farmers, but rather that they should have access to it through their veterinarians. This recommendation is not made lightly, but I consider that placing this restriction on the drug's commercial use will at least help to ensure that New Zealand's pre-eminent position as a meat-exporting country is guarded.

Acknowledgments

Thanks are offered to farmers who cooperated in the field trials; to Messrs R. and W. Hellaby Ltd., Messrs W. and R. Fletcher Ltd., the staff of the Horotiu Freezing Works of the Auckland Farmers Freezing Company, and to Messrs Evans, who supplied the hexoestrol for this work.

Pedigree Pig Improvement Scheme: Qualified Litters

Contributed by the Animal Industry Division

THE following table sets out particulars of litter performance, growth-rate, and carcass quality points for those litters which have qualified in the Pedigree Pig Improvement Scheme for publication since those appearing in the June issue of the "Journal".

Owner	Breeding of litter		Date born	Litter weight at 3 weeks	Dead weight	Growth rate	Carcass test results (average) points								Total points
	Sire	Dam					Length	Back fat Shoulder	Loin	Bal.	Ham	Sh.	L.	B.	M.	
					lb	(25)	(20)	(10)	(20)	(5)	(15)	(10)	(10)	(5)	(5)	(125)
					Class A Baconers											
Graham Whatmough	WS 163	WS 171	27/9/58	148	131	14½	14½	7½+	18½—	1½	8	6	7	5	5	87½
G. E. Heppenstall ..	LW 13947	LW 13737	12/5/58	125	125	22	17	8½+	17+	5	11½	5½	6½	4½	5	102½
					Class A Porkers											
							Maximum	points	(15)						(10)	
S. E. Milnes	LW 14663	LW 14159	10/12/58	125	95	18½	12½	9½+	11—	2	8½	6	5½	5	10	88½
G. C. Yeates ..	LW 15462	LW 15452	24/1/59	134	91	23	18½	8½+	12+	5	11½	7½	6½	3½	10	106
G. C. Yeates ..	LW 15462	LW 15250	12/12/58	133	93	20½	17	10	14—	5	9	6	6½	3	10	101
G. C. Yeates ..	LW 15462	LW 15773	9/12/58	108	93	19	17	10	14+	5	10½	6½	7½	4	10	103½
G. C. Yeates ..	LW 15462	LW 15772	3/12/58	125	107	23	16½	5½+	13—	5	11	7½	7½	4½	10	103½
G. C. Yeates ..	LW 15462	LW 15771	19/2/59	123	88	23½	15	9½+	10+	1½	11½	8	7½	4	10	100½
A. E. Wood	LW 15220	LW 14566	2/12/58	138	71	4	17½	9½—	13—	3	10	8	8½	5	10	88½
B. G. and W. D. Dron	B 30626	B 29538	1/12/58	139	81	23	17	8½+	10+	4½	10½	5	7½	5	10	101
B. G. Potts	B 32628	B 31371	4/1/59	107	65	15½	18½	9+	13—	5	9	6	6½	5	4	91½
					Class B											
B. G. Potts	B 32628	B 31370	20/12/58	101	66	11	18	9+	12—	5	7	7	6½	3½	3½	82½
					Class C											
Victor Hinton ..	LW 14779	LW 14792	8/12/58	88	78	11	16	9½+	15	4½	8	6½	7	5	10	92½

+ Points lost because too much fat. — Too little fat. L. Loin development. B. Belly thickness. M. Marketing points.
The boar Medway White Bonza 5th 15462 has qualified as a merit sire.

Spring Examination of Hives; Destroying Diseased Hives

Seasonal Notes for the Domestic Beekeeper

WITH another honey season under way beekeepers should thoroughly examine all hives until the main honey flow begins. Early spring examination of hives is most important, as on it rest decisions that will determine the progress and welfare of the colony during the critical months to follow.

WHEN hives are first opened early in spring a quick glance at one or two frames taken from the centre of the brood nest is usually enough to give the beekeeper some idea of the condition of the hive generally. Though the condition of colonies will differ in various districts, the competent beekeeper should be able to assess in a few moments the immediate requirements of the hive.

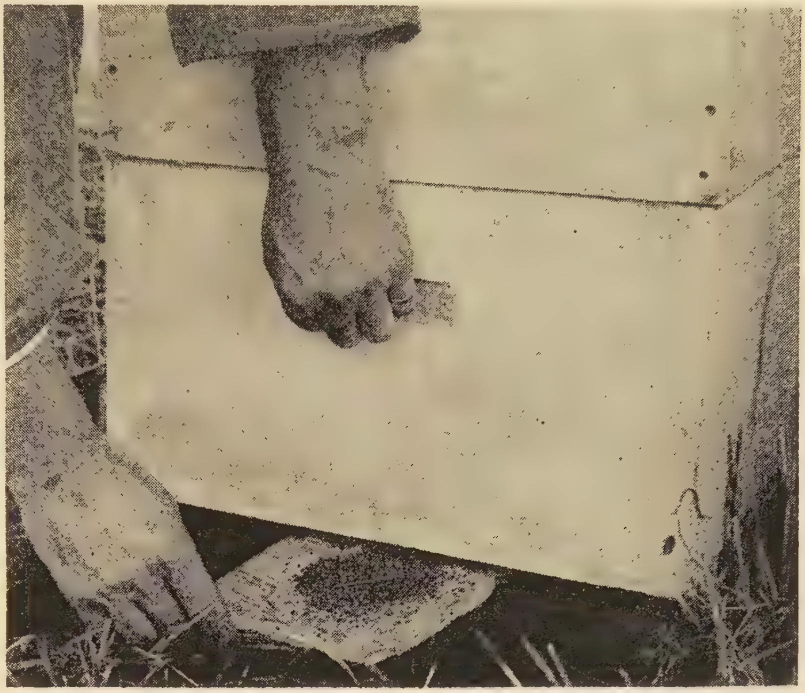
The primary features to observe are the vigour and health of the bees, the colony strength, and the amount of surplus honey in each hive.

The presence of a queen should also be determined. If there are no eggs and both unsealed and sealed brood, the colony is probably queenless. The age and egg laying ability of the queen can be fairly accurately gauged by noting the "brood pattern" or the uniformity with which she lays. The brood should be even in a pattern of concentric circles and show very few empty cells within the brood area. If the actual age of the queen is known, so much the better. For maximum efficiency and honey production hives should be requeened at least every two years with queens from a good Italian strain.

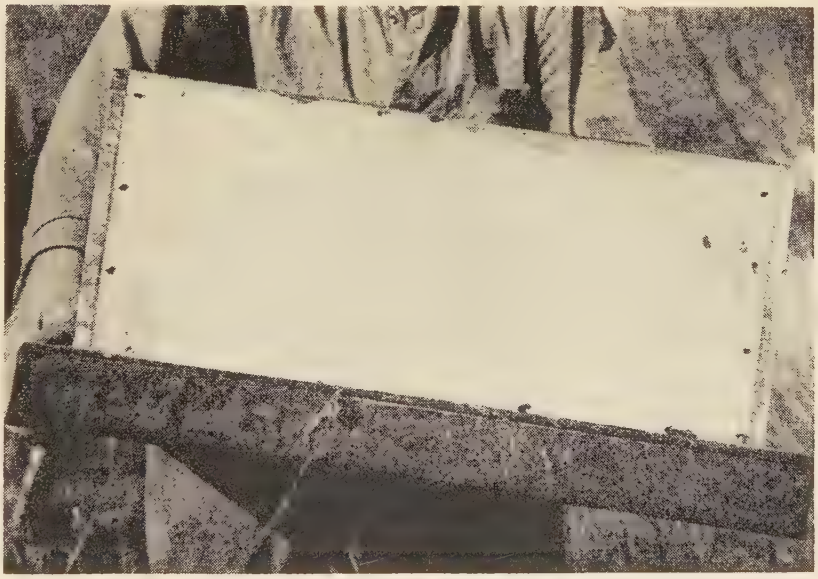
By D. A. BRISCOE,
Apiary Instructor,
Department of Agriculture,
Tauranga

A check on these features early in the season is essential, as later it is sometimes not possible to remedy a trouble which could have been checked if discovered earlier.

In spring, when brood rearing within the hive is in full swing, large quantities of the honey and pollen reserves are consumed and a break in the nectar flow often leaves the colony with very little stores. At this time of the year at least 25 lb of surplus honey stores are necessary to maintain each colony until the main honey flow begins. To avoid risk of loss through starvation colonies with less than this



Gassing of diseased bees with calcium cyanide. The powder is spread on damp cardboard or several thicknesses of paper and pushed into the hive entrance.



Carrying a super of combs in a hive cover for burning prevents dead bees from spilling on the ground.

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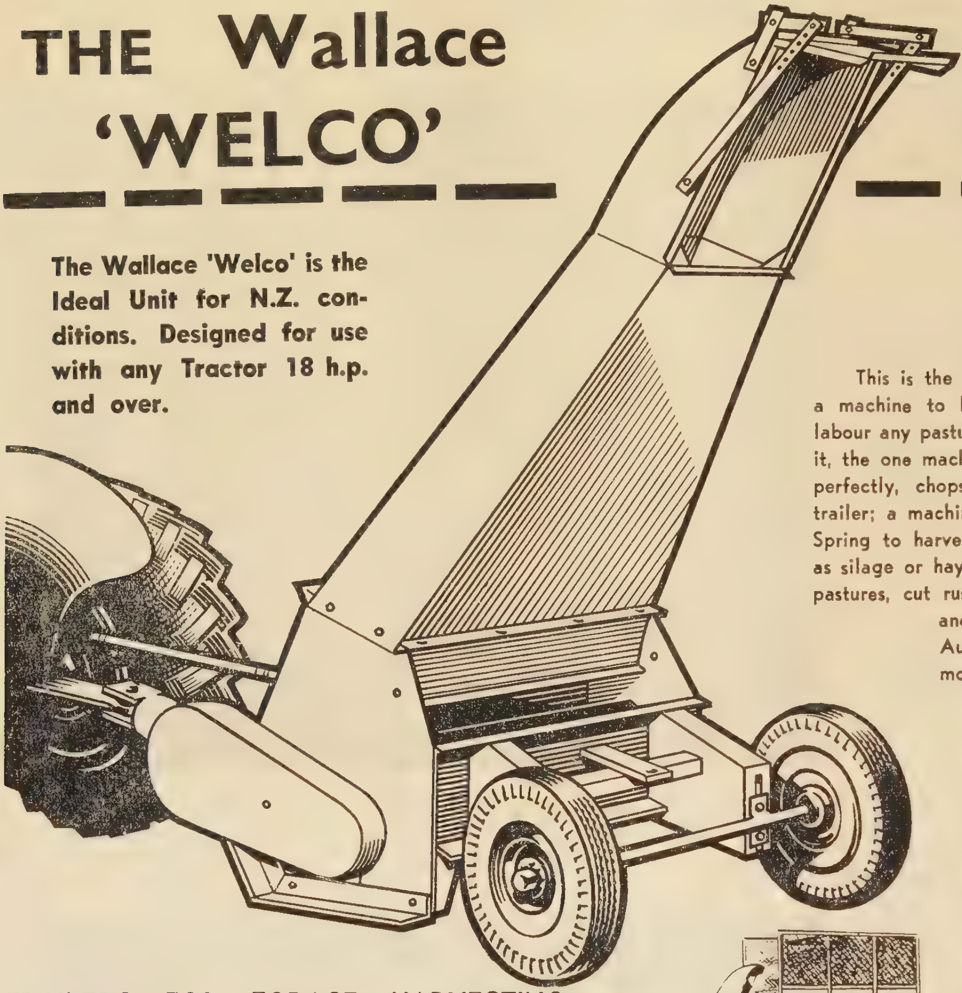

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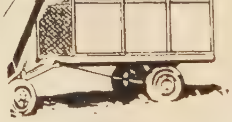

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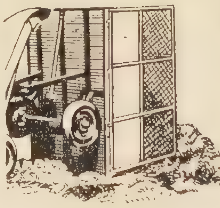

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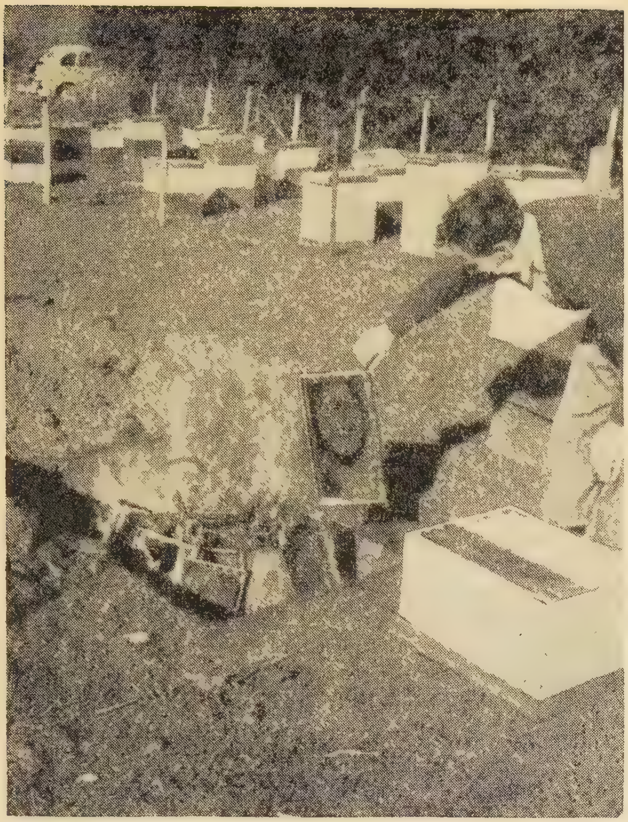
DESTROYING DISEASED HIVES



Method of burning bees and hive contents affected with foul brood.

Supers placed on iron bars above a fire for final → scorching.

amount of honey will require supplementary feeding.

If artificial feeding has to be resorted to, a 50-50 sugar and water syrup should be fed. The simplest way of feeding this is with an ordinary 5 lb honey or similar tin with a press-in lid. Several small holes are punched in the lid and the tin is filled with the syrup and then inverted over the frames of the brood nest and enclosed with an empty super. To prevent robbing care should be taken to ensure that no syrup is spilt round the hive and that the bees are not given any more syrup than can be taken and stored by them in the one night.

Though shortages of pollen occur at times in some districts, it is doubtful if the domestic beekeeper will be seriously affected by this trouble. There are usually enough flowering plants handy to domestic apiaries in populated areas to ensure sufficient supplies for normal brood rearing. If pollen deficiency is suspected, it is advisable to confer with the Apiary Instructor for the district.

Symptoms and Recognition of Foul Brood Disease

In the early stages of American foul brood (*Bacillus larvae*) infection a larva assumes an unnatural position in the cell and then gradually flattens out with its tail turned slightly up and its head lying flat. The dead matter has a coffee colour, is at first slightly viscid, later becomes ropy, and finally reduces to a scale which sticks hard to the bottom of the cell. When the dead matter decomposes it darkens and develops a strong smell resembling that of hot glue.

With the pupa, decomposition is the same except that the tongue appears as a fine thread pointing toward the top of the cell. This characteristic is manifest only in American foul brood.

Cappings of brood affected by American foul brood become dark, greasy, and sunken, with sometimes a small pinhole in the centre of the capping.

Simple Test

A simple test for this disease is to remove the cap from an infected cell and probe the dead matter with a match or straw, which should be given a slight twist and then slowly withdrawn from the cell. If part of the contents of the cell adheres to the stick and ropes out some distance (½ in. or more), it is fairly conclusive evidence of the disease.

Method of Destroying Diseased Hives

American foul brood is a highly infectious disease of bees for which there is no known cure. The disease is transmitted by bees robbing honey from diseased combs and the interchange of infected equipment. Should disease be found, the beekeeper must take immediate steps to dispose of the hive to avoid the spread of infection to other hives.

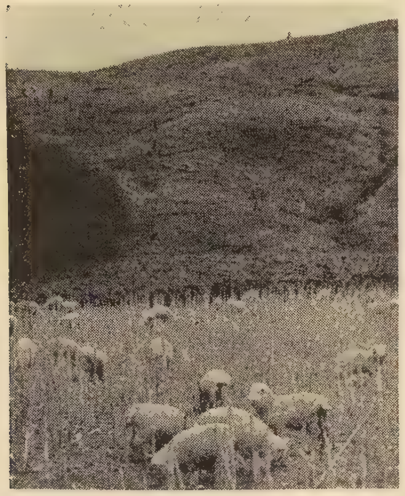
The most effective and safe treatment is to destroy completely all bees, frames, combs, and honey within the infected hive by burning. Supers, lids, and bottom boards that are sound in all respects may be saved, provided these are thoroughly sterilised by scorching.

In some districts, particularly in closely populated areas, it may be necessary to secure a permit from the local fire authority to light a fire in the open. Suitable weather should be chosen before carrying out this work.

The most practical way to kill bees is with calcium cyanide gas. For this purpose it is obtained as granules which when exposed to the air give off a lethal vapour. A level tablespoon

(Continued at bottom of page 372)

Chou Moellier for Facial Eczema Control



CHOU moellier is the most popular all-round crop grown for facial eczema insurance, because it provides a large bulk of high-quality on-and-off grazing over dangerous periods, which may extend from February to April.

DISEASE and insects are not serious in chou moellier once it is established, but a small insect, the springtail, can sometimes destroy a germinating crop overnight. Springtails can be killed with 2 pints of 20 per cent lindane in 100 gallons of water, and for protection this can be applied within a day or two of sowing the crop.

Weeds are no great problem now that *Amaranthus* (redroot or Prince of Wales feather), the worst weed of chou moellier in warmer districts, can be satisfactorily controlled with the weedkiller monoxone. Applications of 15 lb per acre in 20 gallons of water are effective. Treatment should preferably be at an early stage of weed growth, though chou moellier itself has been unharmed by applications made between the five to eight leaf stage and growth up to 2 ft tall.

Climate and Fertiliser

Chou moellier will tolerate a wide range of climatic conditions and grows on most soils not subject to extremes of wetness or dryness. It responds to liberal dressings of mixed fertiliser in the proportion of 4 cwt of serpentine superphosphate to 1 cwt of blood and bone. Potash should be applied if a deficiency is suspected, but separately from the seed to avoid germination injury.

Cultivation should be thorough, with seeding rates from 2½ lb per acre in 28 in. drills to 4 lb broadcast. The higher rates results in a thinner-stemmed crop suitable for sheep. As this crop takes three and a half to four months to mature it will be necessary to sow in October to be ready by February.

Break Feeding

For a flock of 1,000 ewes an area of 10 acres is suggested and should be break fed, especially if the crop is so limited that a hay supplement is required. Break feeding permits a flexible balance to be maintained between any hay ration on the restricted run-off and the area of crop being grazed hourly or daily.

Lambs must be given priority if the crop is limited. Whereas ewes will maintain reasonable condition for some weeks on their ration of 2 lb of hay per day with access to water, young animals react badly to restricted grazing.

When cultivation has been delayed white-fleshed turnips are the next best alternative, provided a long-keeping variety like Green Globe is sown, which should be ready to feed off between 10 and 16 weeks.

—H. McM. BULL,
Farm Advisory Officer,
Department of Agriculture,
Auckland

Destroying Hives

(Continued from page 371)

of the granules is placed on a piece of paper or cardboard and this is inserted in the hive entrance.

Beekeepers must realise that calcium cyanide is a deadly gas. The powder should be handled so that no fumes are inhaled by the operator.

Another method of killing bees is with petrol. First block the entrance to the hive with grass; remove the lid and pour at least a pint of petrol over the frames and then close the hive again. Within a few minutes the petrol fumes will have killed all the bees. **No naked light should be exposed near the hive.**

While the petrol or calcium cyanide fumes are taking effect dig a trench 3 to 4 ft wide and not less than 18 in. deep fairly handy to the hive or wherever it is safe to burn it. Place two iron bars or pieces of pipe across the trench to prevent the fire from collapsing and keep the centre of the fire open. When these preparations are complete carry the hive carefully to the side of the trench, making sure that no dead bees are dropped about the ground. Similar care is necessary when transferring the combs from the hive to the fireplace, as spilling bees and honey on the ground is a means of spreading the infection.

The fire is prepared in the following manner: First, place some paper and dry sticks in the centre of the trench and then stack the combs from the hive on their ends round this material. Start with any dry combs or combs with only a little brood, then the remainder of the brood combs, and lastly the combs containing honey. Pour kerosene over the complete mass and put a match to it. At this stage the dead bees that have accumulated in the bottom super and on the bottom board should not be placed on the fire, as they would tend to smother it. Once a fire of this kind goes out it is very difficult to get it going again properly. The dead bees may be poured into one side of the hole once the fire is at its height, but on no account should they be poured on the top of the fire.

When the fire has subsided a little, the salvable supers, lids, and bottom boards may be given a good scorching. After removing the metal rebates and throwing them on the fire, turn the supers with rebate edges down and place one on top of the other on the two iron bars above the fire. By this means a draught is created and the flames are drawn up through the supers as in a chimney. When supers have been over the fire long enough to burn all particles of wax from the interior and to just blacken the timber itself, push the stack over and remove supers from the fire. Lids and bottom boards should be treated in much the same way.

A blowlamp may be used instead to scorch or sterilise equipment. The flame can be directed with more control on parts of the equipment that may require a little more fire than the rest.

As soon as the fire has burnt out completely cover the hole with earth; this is very important, as once the honey in the bottom of the trench cools sufficiently it becomes an attraction to searching or robber bees.

The success of eradicating American foul brood depends on the vigilance of beekeepers in recognising the presence of the disease while it is in the initial stages of development and the efficiency with which the treatments just described are carried out.

Once American foul brood has been found in an apiary the beekeeper must take immediate steps to eradicate it. Treatment cannot be delayed until a more convenient time. The owner of infected hives is required by law to notify the district Apiary Instructor within seven days of the outbreak.

New Zealand Weed Control Conference

INTEREST in chemical methods of weed control is increasing throughout New Zealand as the successful practical use of chemicals becomes widespread. The subject is also becoming more complex as the range of chemicals available for weed control becomes greater, and a representative gathering, the Weed Control Conference, meets annually to keep up to date with developments. At the twelfth annual conference held at Tauranga in July this year about 150 members were present, representing manufacturers and distributors of weedkillers, Instructors in Agriculture and research staff of Government departments, farm advisers, weed-spraying contractors, farmers, noxious weeds inspectors, and other local body officers.

▲ Inspection during the field day of a drain bank which had been sprayed for weed control by the logarithmic sprayer some months earlier.

THE first paper was by A. V. Allo and dealt with weed problems of the Bay of Plenty. The type of farming practised in the early days of the settlement of the area had been responsible for many of the present weed problems. For instance, Indian doub, which is a problem in cultivated land, was sown in the early days, as it was one of the few pasture species capable of growing under the prevailing low-fertility conditions. The same could be said of browntop. Ragwort would never have been so serious a problem had not bush sickness prevented sheep being carried on much of the country.

On land developed after burning bush or scrub subsequent weed problems can be largely avoided if the new pasture is properly established and managed. Where adequate phosphatic fertilisers are applied and the area fenced so that stock can be crowded on to it weeds can be kept under control and a satisfactory sward developed provided "cheap" seed containing weeds is not used and, if the area has been cultivated, the seedbed is well consolidated. If due attention is not given to all of these factors, a poor sward may result which could become invaded with any of the following weeds according to the circumstances: Ragwort, Australian fireweed, fleabane, inkweed, sorrel, foxglove, and flat weeds.

Mr Allo also dealt with weed problems of both low- and high-fertility pastures, swamps, and cropping and horticultural areas. In conclusion he said that weed control in the Bay of Plenty has made great advances since 1946 largely because of the introduction of hormone weedkillers, but there are still some weed problems for which satisfactory control measures are not available.

Dalapon

Several papers dealt with the use of dalapon, a grass weedkiller becoming more important because it is being used for various purposes such as control of barley grass, grasses on drain banks, and grasses in lucerne. When it is used for the control of barley grass in pasture it is important to know how much can be applied without causing too much damage to the desirable pasture grass. On the other hand when dalapon is applied to destroy existing swards before cropping, as in chemical ploughing, it is necessary to use sufficient to kill the pasture grasses.

Dalapon is also used to control grassy weeds on drain banks. It is therefore important to know how much dalapon is required to kill various grasses under different conditions. In a paper by A. Thompson results were given of trials to study factors which influence the effect of dalapon on grasses. It was shown that ryegrass tends to be more susceptible to dalapon damage when treatments were applied to very short or immature growth. Higher and more mature growth was more resistant. Ryegrass growing on high-fertility spots was more resistant than that growing on areas of lower fertility. Cocksfoot when small and leafy showed variations in resistance similar to ryegrass. On the other hand clumpy cocksfoot of the type which develops on ungrazed areas was more susceptible to dalapon when the regrowth after mowing was 10 in. high than when it was shorter.

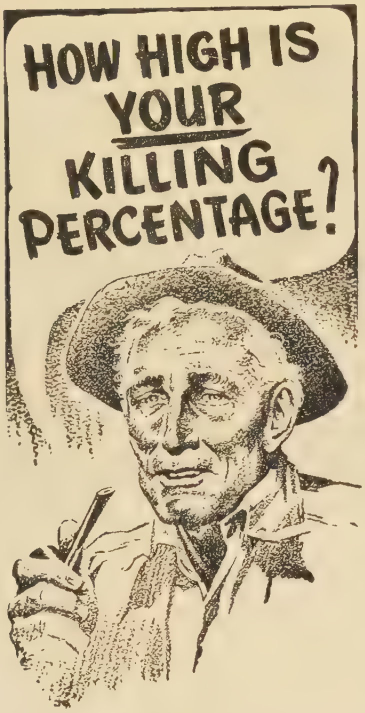
F. A. H. Meeklah dealt with the results of trials with dalapon for controlling grassy weeds in lucerne. When dalapon was applied to established lucerne in early spring, though there was an appreciable reduction in yield at the first cut, the treatment had little or no effect on subsequent yields. Treatments after the first cut, after the last cut, and in the late dormant stage, however, resulted in more prolonged depression of yield.

The use of dalapon, amitrol, and 2,4-D for controlling weeds in drains has reduced the cost of maintaining drains in the Hauraki Plains, according to G. L. Banfield. "There is no doubt," he said, "that we now have a remarkably effective range of weedicides suitable for complementing the work of the mechanical drain cleaner. By their use we cannot fail to increase drainage efficiently and reduce drain maintenance costs to a fraction of their former level."

In a paper by L. J. Matthews on chemical ploughing results of a trial were quoted which showed that chemical ploughing gave higher yields of white-fleshed turnips than those obtained on cultivated plots, provided the rate of chemical used was sufficient to kill the grasses in the previous sward. The chemical method may have application where it is not possible or convenient to cultivate or where cultivation results in weed problems for which there is no satisfactory method of control; for example, fathen in brassica crops. However, more information is required regarding the factors governing pasture and crop establishment with the chemical method before it can be recommended generally. Some of these factors are the seeding rates, fertiliser requirements, and the residual toxicity of the chemicals.

Gorse Control

The results of a trial in which costs were obtained of various methods of controlling gorse and developing un-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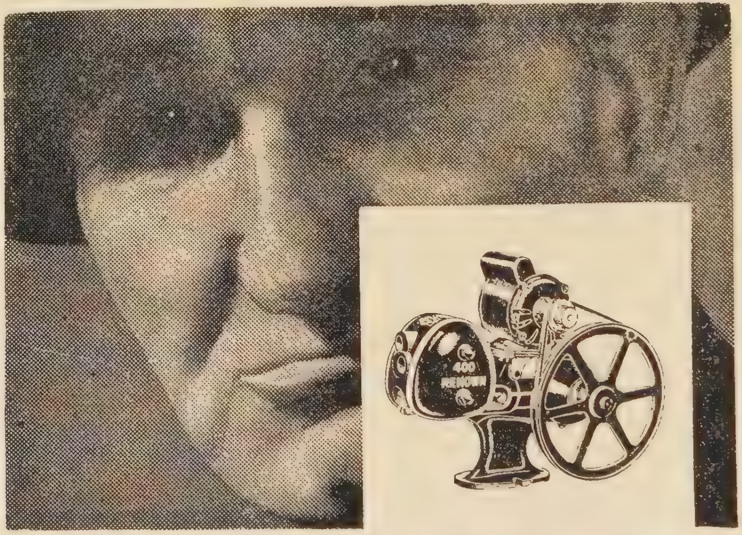

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ploughable hill country were given by J. D. Currie. The gorse on different blocks was burnt, sprayed from the air with 2,4,5-T, or sprayed from the ground. After oversowing there was some gorse regrowth on each block which could not be controlled by stock and this was spot sprayed. Burning of the gorse was the cheapest method because the other methods had the additional expense of prior spraying with 2,4,5-T.

A good burn and adequate stock control of gorse seedlings were important factors. In dealing with these, Mr Currie said "On a farm with an average gorse density spot spraying will soon have the gorse confined to the dense blocks, after which the number of acres able to be tackled will be entirely governed by the number of sheep available. In our experience cattle were never necessary, but up to 30 sheep per acre were required for up to three weeks at the height of the spring seedling regrowth. If we have a 20-acre block being developed, we will require 600 wethers and straight after this nearly all these 600 wethers will have to be elsewhere. On a hill farm carrying two sheep per acre a balance of 300 acres of grass would be required if we were not to lose money on our stock. It is far better to take a small block and do the job properly.

"A dense three-year-old block of gorse should be selected early and closed to let a tinder dry, thick fern and grass undergrowth build up by February. At the same time the block must be ring-fenced to keep the stock out while the undergrowth thickens and to crush sheep on after the burn. I believe the £2 a chain four-wire sheep electric fence has a great potential for this work.

"The best burn will be obtained in February or March on a day of low humidity combined with a light drawing wind. Oversowing in the ashes is not critical, but seed oversown must be Government certified and have a high proportion of clovers to compete vigorously with the gorse seedlings and fern fronds, and all the required fertilisers must be spread. Immediately after the burn and even before oversowing, heavy stocking with sheep is essential. Pasture establishment after gorse is usually very good and it is largely a matter of good husbandry, both field and animal, to keep those seedlings out. It is better to sacrifice your paddock by stocking too heavily and too long rather than to nurse the pasture. Sheep must be done harder on many occasions than one would like to as a good stockman, but this is absolutely necessary when you realise that every seedling that hardens is lost to stock control and must be sprayed."

Papers and Speakers

"Weeds of the Bay of Plenty" **A. V. Allo**, Farm Advisory Officer, Tauranga

"Effect of Dalapon and Amitrol on Various Grasses" **A. Thompson**, Technician, Rukuhia Soil Research Station, Hamilton

"Lucerne Tolerance to Dalapon" **F. A. H. Meeklah**, Technician, Invermay Research Station, Mosgiel

"Simazine" **D. V. Gordon**, Ivon Watkins Ltd., New Plymouth

"Use and Limitations of Chemical Ploughing" **L. J. Matthews**, Senior Scientific Officer, Wellington

"Review of the Use of the Phenoxybutyrics in New Zealand" **J. N. Fitzgerald**, Technical Officer, J. H. Barbour and Son Ltd., Wellington

"Use of Seeding Rates and Weedkillers for Control of Weeds in Newly Sown Pastures" **N. A. Cullen**, Scientific Officer, Invermay Research Station, Mosgiel

"Gorse Control on Unploughable Hill Country" **J. D. Currie**, Farm Advisory Officer, Hamilton

"The Gorse Seed Problem" **G. R. Moss**, Farm Advisory Officer, New Plymouth

"New Aspects of Chemical Control of Weeds in Drains" **G. L. Banfield**, Farm Advisory Officer, Thames

"Manchurian Rice Grass" **E. H. Arnold**, Assistant Fields Superintendent, Department of Agriculture, Auckland

"Barley Grass Control" **D. E. Merry**, Farm Advisory Officer, Pukekohe

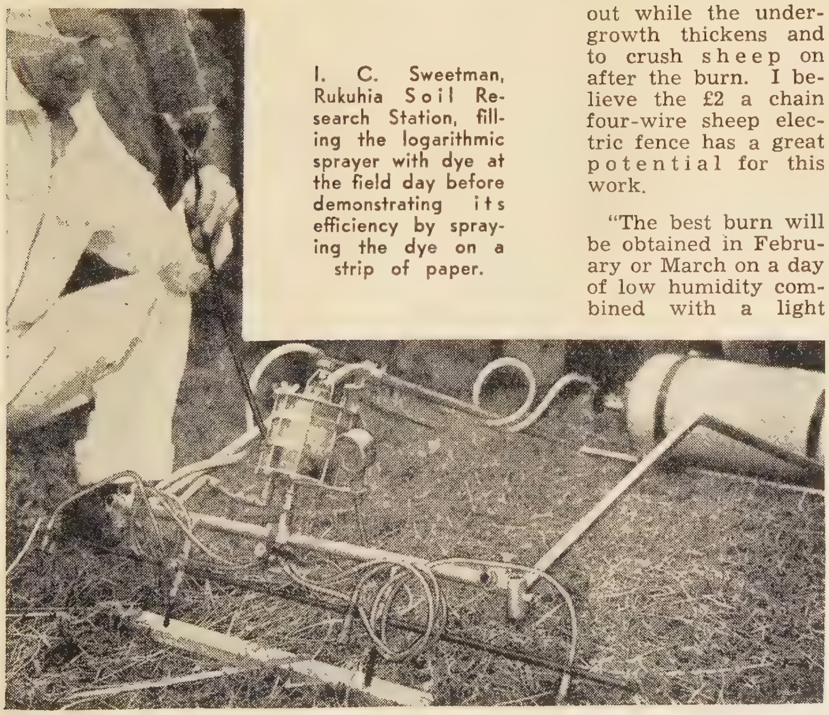
"The Significance of Buried Weed Seeds in Agriculture" **G. S. Harris**, Scientific Officer, Grasslands Division, D.S.I.R., Palmerston North

"Absorption and Translocation Studies Using Labelled Herbicides" **O. Leonard**, Botany Department, University of California, and **J. S. Yeates**, Head of Agricultural Botany Department, Massey Agricultural College, Palmerston North

"Weed Control in Fodder Crops with Monochloracetate" **F. B. Thompson**, Principal Scientific Officer, Rukuhia Soil Research Station, Hamilton

"Weed Control in Berry Fruits" **J. Porter**, Scientific Officer, Horticultural Research Station, Levin

Printed Proceedings of the Conference, containing all the papers and discussions, may be obtained for 15s. a copy from the Secretary, Weed Control Conference, Department of Agriculture, P.O. Box 2298, Wellington.



I. C. Sweetman, Rukuhia Soil Research Station, filling the logarithmic sprayer with dye at the field day before demonstrating its efficiency by spraying the dye on a strip of paper.

Some of the conclusions in a paper by G. R. Moss dealing with the dispersal of gorse seed and the longevity of the seed in the soil were similar to those of Mr Currie. Mr Moss said: "On unploughable areas burning is essential to reduce the

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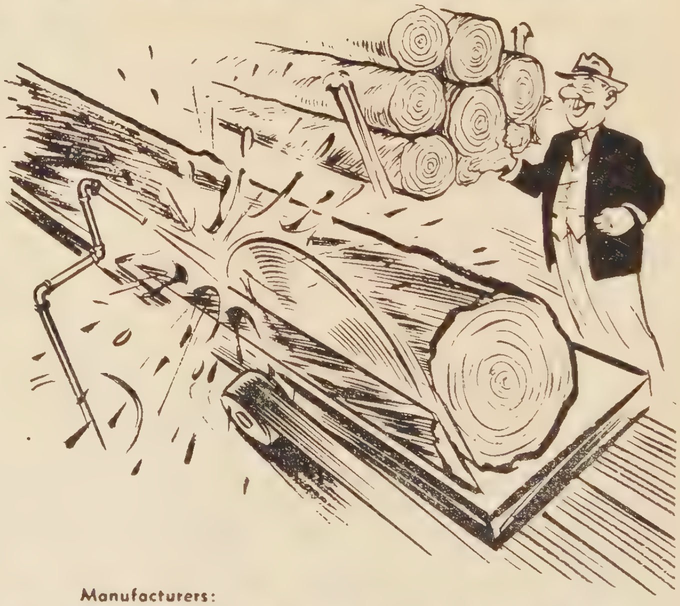

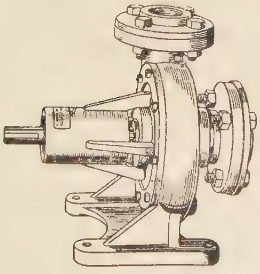

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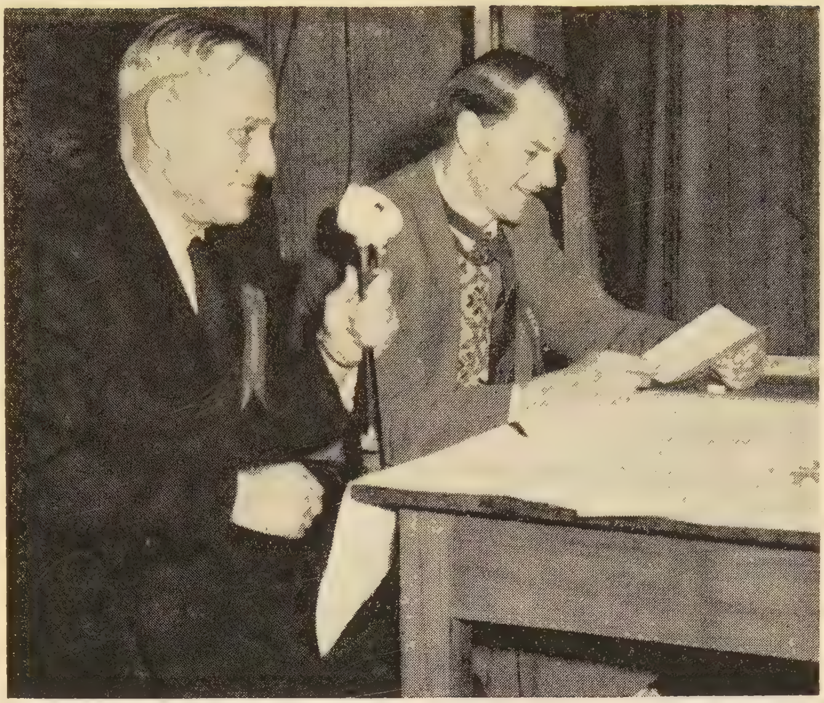
potential danger from hard seeds in the soil. The aim should be for a hot fire to kill or to render permeable to soil moisture as many gorse seeds as possible so that they can germinate quickly. This reduction in the number of hard seeds in the soil is an important factor in gorse control. It may be possible to burn some areas satisfactorily without prior treatment or it may be necessary to cut and burn or spray and burn. It is impossible to generalise on gorse eradication because of differences in topography and climate.

"If a cleared area is not reseeded, some of the gorse seeds could survive in the soil and germinate for up to 30 years. The first 10 years are the critical years where pasture management is very important. If at any time the sward is opened up by overgrazing or slips and stock are unable to control seedling growth, spraying will be necessary.

"The cheapest method of controlling seedling growth is with stock. If stock are to be used efficiently, they must be concentrated.

"There would be no gorse problem in New Zealand today if we had not planted gorse hedges. We can never hope to get rid of gorse as a weed until every gorse hedge has been destroyed."



J. E. Bell (left), president, and L. J. Matthews, secretary, of the Conference during one of the lively discussions which followed papers.

Other Papers

G. S. Harris in a paper on buried weed seeds said: "In one sample from a five-year-old pasture there were present 24 million fathen, 16 million dock, and 160 million other seeds per acre. Under such conditions the probability of weed competition with any succeeding crop, arable or pastoral, is self-evident as is the cost of adequate weed control measures."

On barley grass seeds, he said: "They may last over one winter, but certainly no longer. Unless seeding is prevented, there can be a rapid and appreciable build-up in buried seed numbers by the end of summer, but this will not last for long owing to prompt germination of the majority of the seeds."

Results of trials with monochloracetate (MCA) for control of weeds in brassica crops were given by F. B. Thompson. Applications of 15 lb per acre of MCA can be recommended for control of most broad-leaved weeds in chou moellier and swedes, if the material is applied after the crops have four true leaves. Fathen and grassy weeds resist MCA, and it is of little value if these are the dominant weeds. White-fleshed turnips are more susceptible than the other brassica crops and should preferably not be sprayed before the six true leaf stage. At this stage the crop is liable to cover most of the ground and shelter the weeds from the spray, and in practice it is probably better to wait until the weeds rise above the crop and then to spray.

Keen interest was taken in all papers, and discussion time was fully occupied.

Field Day

Four bus-loads of conference members were shown the type of farming in the district during a trip to Mt Maunganui and Papamoa. A stop was made at a farm for a demonstration of a logarithmic sprayer made by I. C. Sweetman, Technician, Rukuhia Soil Research Station, Hamilton.

This sprayer continually dilutes at a constant rate the chemical being sprayed. Consequently on a strip thus sprayed there is a high rate of chemical at one end and a low rate at the other. The rate of application at any point along the strip can be determined by measuring the distance from the starting point. This was clearly demonstrated in the field by spraying a dye on a strip of paper.

By using this type of sprayer the minimum rate of weedkiller required to kill a particular plant can be determined more easily than by spraying individual plots with various rates of the material. The visitors were shown a drain bank which had been sprayed in March with the logarithmic sprayer. This showed good control of the weeds with lower rates of chemical than had been recommended previously.

Various types of logarithmic sprayers have been developed overseas since the first one was made in England several years ago. These are cumbersome because it is necessary to include mechanism to mix rapidly the diluent and concentrate.

Mr Sweetman had modified parts of an imported sprayer, and he used compressed air for both mixing and delivering the spray solution. The modification was fitted to a portable spray unit designed by officers of the Department of Agriculture, and the complete sprayer was inexpensive, easily carried, and would fit in the boot of a car. This sprayer was considered an advance on those available overseas for experimental work.

Next Conference

The general meeting decided that the next conference should be held in Invercargill in July 1960.

The officers elected for the ensuing year were: President, J. N. Fitzgerald (Wellington); vice-president, F. C. Allen (Christchurch); secretary, L. J. Matthews (Wellington); committee, J. E. Bell (Auckland), P. S. Ferens (New Plymouth), M. S. Foreman (Christchurch), P. B. Lynch (Wellington), A. R. Rankin (Invercargill), and F. B. Thompson (Hamilton).

—*F.B.T.*

Mixed Age Versus Cast-for-age Ewes in Fat Lamb Production

IN the perplexing question of buying mixed age or cast-for-age ewes in fat lamb production the decision in favour of young ewe buying could be actuated by reasoning such as the following:

The old ewes seem so dear!

Why should I buy five-year ewes at 50s. to 65s. when I can get 2-tooths with all their life in front of them for a matter of 30s. more?

C. P. Tebb, Field Officer, New Zealand Meat and Wool Boards' Economic Service, Hamilton, in a paper he gave to this year's Ruakura Farmers' Conference Week discussed this question and an adaptation of the paper is given here.

THE best way to attempt to answer the question, and certainly the only logical way, is to take the facts and figures of many farms over a considerable period and average out the results. In this way divergencies of season, of situation, and of personal ability in buying and in husbandry are more or less levelled out.

A five-year period seemed to be a reasonable minimum and of the seven years' total of records available to me I have picked 1952-53 to 1956-57 for two very good reasons. Firstly, I have more farm records continuously effective over that five-year term than for a similar term starting one year earlier or one year later, or for the full seven years; secondly, and more important, the market for stock and wool was steadier over this period than over a five-year period starting a year earlier or later.

Out of my panel of some 105 randomly selected sheep farms whose owners are cooperating in the Meat and Wool Boards' continuous economic survey I have 37 fat lamb farms of the intensive type. Of these:

Only six bought consistently and solely 2-tooth ewes over the five years,

Only four bought consistently and solely cast-for-age ewes over the five years,

which means that only 10 farms (about a quarter) were effective to this discussion.

The other 27 had to be rejected from this analysis because:

Ten farmers were breeding some of their replacements

Nine farmers were buying part 2-tooths and part cast-for-age, with a definite 2-tooth tendency

Three farmers were buying ewe lambs

Two farmers changed from cast-for-age to 2-tooth buying half way through the period

Three farmers came into the survey too recently to meet the requirements of the five-year period (incidentally all these buy young ewes)

▼ A mixed age flock on a Waikato fat lamb farm.

DATA ON GROUPS OF NORTH ISLAND FAT LAMB FARMS AVERAGED FOR FIVE SEASONS 1952-53 TO 1956-57

	North (Waikato, Bay of Plenty, and Franklin)		South (Hawke's Bay, Manawatu, and Rangitikei)	
	2-tooths	Cast-for-age	2-tooths	Cast-for-age
1. Average productive acreage	338	288	350	289
2. Sheep wintered				
Total	1,495	1,328	1,236	1,171
Dry sheep in above	138	102	116	106
Cattle wintered	140	87	49	28
3. Ewes to ram	1,357	1,226	1,120	1,065
Lambs docked (number)	1,266	1,243	1,143	1,169
Percentage	93	101	102	109
Own lambs sold fat	1,183	1,157	1,061	1,100
Other lamb sales	13	88	68	48
Lambs lost after docking (per cent)	3	3	2.5	2.6
4. Ewes sold (number)	287	379	181	664
Return per head	£1.64	£1.66	£1.96	£1.76
Proportion of ewe flock (per cent)	21	31	16	62
5. Ewes bought (number)	369	481	266	773
Cost per head	£4.32	£2.86	£4.0	£2.64
Proportion of ewe flock (per cent)	27	39	24	72
6. Fat lamb meat weight:				
Per fat lamb sold (lb)	32.0	30.7	33.8	34.2
Per ewe mated (lb)	28.0	29.0	32.0	35.3
Other meat per ewe mated (lb)	16.0	13.0	10.0	4.7
7. Wool clip per grown sheep (lb)	9.4	9.2	10.3	10.2
8. Gross profit per ewe mated:				
From sheep and lamb	£2.05	£1.98	£2.48	£2.32
From wool	£2.08	£1.77	£2.12	£2.28
From cattle	£0.97	£0.74	£0.30	£0.44
Total	£5.10	£4.49	£4.90	£5.04
9. Winter stock rate, sheep	4.34 E.E.	4.54 E.E.	3.47 E.E.	4.0 E.E.
Plus cattle at	1 to 10 ewes	1 to 14 ewes	1 to 23 ewes	1 to 38 ewes

Bearing in mind that my total panel of farms is a statistically random selection by counties in relation to sheep population density, and is in no way specially selected, the returns show a preponderance of fat lamb farmers adopting a mixed buying and/or breeding tendency and a quite definite bias toward the young ewe.

The reduced size of my effective panel of farms for this study led me to enlist the assistance of my colleague in the southern half of the North Island, T. O. Walshe at Feilding. He took out similar returns for his farms under survey and sent me data from his effective 2-tooth and cast-for-age farms over the same five years. The situation on the fat lamb farms in the south of the North Island was not dissimilar to that in the north. He had 43 intensive fat lamb farms of which:

Twelve farmers were consistent 2-tooth buyers

Seven farmers were consistent cast-for-age buyers

Twenty-four cases had to be rejected for:

Nine farms bred some ewes

Seven farms bought partly 2-tooth and partly cast-for-age ewes

Three farmers changed their buying policy during the period

Five farms had incomplete records

This showed a very similar trend to mine, a definite tendency toward young ewes bought and/or bred.

With the returns to hand from my southern colleague I was ready to lump all 2-tooths and all cast-for-age ewes together to form two composite North Island samples.

However, while I was waiting for the southern material, I had worked out major totals and averages of my own groups purely as a matter of personal interest, and I subsequently worked out the southern figures separately to see how they compared with the northern ones.

After seeing the results I decided to leave the two groups, north and south, separate, as this shows up at least one important point which would otherwise be completely lost in the larger composite sample.

The sample is not large; certainly not large enough to satisfy a statistician as an irrefutable representation of North Island fat lamb practice and returns. However, it is truly random and is the maximum sample available after making only legitimate rejections for non-compliance with the specifications of this study.

[The table above presents data discussed in the following text.]

North and South

North in the table refers to my group of farms. They lie in Waikato, Bay of Plenty, and Franklin (fat lamb farms which I have in Northland and King Country fall into the rejected category). South refers to Mr Walshe's group which lie in the recognised fattening districts of Hawke's Bay, Manawatu, and Rangitikei.

1. Production Acreage

Item 1 in the table shows the average productive area of each group of

▼ Cast-for-age five-year-olds in mid winter.

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farms. It would appear that the larger holdings tend to favour the young ewe in both groups.

2. Sheep Wintered

Item 2 in the table gives the average winter stocking; all the figures from now on are the **average annual** result over five years in each group of farms. Note that again there is a similarity of pattern between 2-tooth and cast-for-age ewes.

In both north and south groups the 2-tooth farms carry more dry sheep and nearly double the cattle of the cast-for-age farms. Dry sheep comprise rams, of course, plus as a rule some late lambs held over, or in a few cases some bought-in hoggets or wethers. Often there is quite a variation from season to season in numbers of dry sheep. To discuss cattle would involve considerable time at the expense of the question at issue, the ewes. Over the various groups they are representative of cattle practices associated with fat lamb farming.

3. Ewe Mating and Lambing

Ewe mating and lambing statistics are given in item 3. The lambing percentages are what I would expect in my experience: A differential of some 7 or 8 per cent in favour of cast-for-age; and southern lambings some 7 or 8 per cent better than northern.

Lambs lost after docking means from docking until the following 30 June. This wastage is seldom less than 2 per cent and it needs only the occasional farm with facial eczema or pulpy kidney to step this percentage up considerably.

Own lambs sold fat needs no elaboration; other lamb sales cover own lambs sold as stores plus bought-in lambs turned over either fat or store. The docking tally cannot be reconciled with the sum of all lambs sold plus percentage loss, because of the intake of bought lambs which I have not tabulated.

4. Ewes Sold

There is virtually no difference in the average per head return of ewes sold in the north groups. In the south groups there is a somewhat better return, particularly from 2-tooths.

5. Ewes Bought

Observe that the north groups pay about 6s. more on average for their 2-tooths and 4s. more for their old ewes than the south groups. But the relative difference between the buying of young and the buying of old ewes is very much the same for north and south, say 30s. and 28s. From left to right the average cost of ewes bought in is 86s., 59s., 80s., and 53s., prices that would be expected over the years considered.

The differences between sales and intake from left to right work out at 6 per cent, 8 per cent, 8 per cent, and 10 per cent. These figures represent the average annual wastage that occurs in these flocks, inclusive of dog tucker and home consumption.

A check of the total sheep wintered at the beginning and end of the five-year period for each group showed that the north groups remained perfectly steady, but that the south groups increased their winter sheep carried by 6 per cent in 2-tooth and 7 per cent in aged; a per cent a year, say, so that really the group wastages are north 6 and 8 as before, but south 7 and 9. This is about what I would expect.

Agronomist Helps Japan

MR W. V. HADFIELD, Farm Advisory Officer, Department of Agriculture, Timaru, who recently spent two months in Japan assisting the Japanese Government in the planning of grassland development projects. The Japanese are building up a dairy industry in the north of their country and Mr Hadfield assisted in the development of grassland projects on a considerable area of poor land, much of it hill country, on the islands of Honshu and Hokkaido. New Zealand has already given some help in this field through the Food and Agriculture Organization of the United Nations, and Mr Hadfield's assignment followed a Japanese request to FAO for some further expert assistance.

Of great interest are the differences revealed in replacement rates of the old ewe groups. In the north group the replacement rate is about one-third, while in the south group it is nearly three-quarters. In the south a complete clearance is sometimes made annually and a 50 per cent clearance is common. To put it another way the north tends to make the cast-for-age ewes last for two or three years and south only one or two years. The 2-tooth groups show little difference between north and south and on average a quarter of the ewe flock is replaced each year. This seems a high replacement rate and shows that the 2-tooth that starts on fattening country generally has a short life, certainly does not go to six or seven years.

6. Meat Weights

The weight of meat produced in terms of per ewe and per lamb is shown in item 6. The stocking rates of these farms vary, not unexpectedly, as is shown in item 9, and per acre carrying capacity has not necessarily anything to do with the fact of buying young ewes or old ewes for intensive country. Therefore to start talking in terms of production **per acre** would be quite confusing and indeed erroneous in this case. Hence, production is in terms of **per ewe mated,** since this is the unit being compared. In item 6 therefore, we find that the average lamb weights are a little better further south per lamb and a good deal better **per ewe mated.** I associate this with the substantially less cattle activity on those farms coupled with the better lambing results that always seem to be achieved in the south districts.

Other meat per ewe mated refers to all other stock sales that are not "own fat lamb"; that is, own store lambs, bought lambs or sheep turned over, the cast-out ewes, and the cattle turnover. This is a net figure derived in our statistical calculations of meat production and takes account not only of the disposals I have just referred to but also the intake stock and stocks on hand at beginning and end of each season.

Though lamb meat per ewe is so much better in the south groups, the other meat is very much less. By adding together the last two items in each column of item 6 the total net meat per ewe mated is found to be 44, 42, 42, and 40 lb. In total meat production the north groups each show 2 lb per ewe more than their south counterparts, which highlights the fact that what the north drops in lamb it more than makes up for by cattle in meat output.

In both north and south the 2-tooth group shows 2 lb more meat in aggregate than the cast-for-age group, such extra being mainly associated with the cattle and not the sheep.

7. Wool Clip

In item 7 the wool clip per head discloses nothing significant as between 2-tooth and aged groups. This may raise a storm of protest and doubt, but I can only point out that

FAT LAMB . . .

later, in the financial section, there is again no consistent evidence that favours the buying of 2-tooth ewes for higher wool revenue in the average of the five-year term. It does so in one place and then the position is reversed in another. I think the answer lies in the rapid deterioration of the young ewe and the fleece weight with it. Note that the per head clips are not per ewe but per grown sheep shorn. Where dry sheep are carried it is virtually impossible for me to get at a strictly per ewe figure.

8. Gross Profit Per Ewe Mated

The financial gross returns per ewe mated are shown in item 8. The totals in three cases are near enough to £5 per ewe mated. Only in the cast-for-age northern group is there a divergence, 10s. less than the others.

The financial result is very much on a par with what happened in the meat section; what is lost in lower northern sheep and lamb production is picked up on beef. The wool cash return is similar to the return from sheep meats, about fifty-fifty. This is normal for fattening farms over those years on the basis of our Dominion statistics.

But why is the north cast-for-age group 10s. lower than the other three? The answer lies mainly in the tendency of that group to have retained the ewes longer than was desirable for best output. Facial eczema may be in some measure responsible **(but certainly not wholly)** for the lower gross return of this group, for it did bear somewhat more heavily here than in the other three groups, all groups being affected between 1955 and 1957.

Farming Expenditure

The table does not include any data on farming expenditure. I regard it as irrelevant except possibly for farm labour costs. Talking in terms of net profitability gets one right away from the point, because one then brings in items that have no bearing on the ewe question. (In terms of gross profit the cost of intake stock and the difference between value of beginning and end stocks on hand have been covered.)

As regards wages and contracting work, supposing it is claimed that the young ewe flock requires more shepherding and general farm work, I examined the labour status of all the farms. They are mostly one and a half man propositions, owner and casual. A few are two men, owner and one permanent; a few are owner virtually single handed. The average annual wage bills, reading the groups as usual left to right are £850, £544, £501, and £591. This includes shearing and contractors. I do not therefore consider that the labour cost factor alters the comparative picture shown by my gross returns.

Topdressing, incidentally, is normal for all groups. It has averaged the full area for north groups and two-thirds of the productive area for the south groups annually.

Conclusion

In conclusion, if I were to show this study simply as a North Island sample instead of in two groups, north and south, the differences between 2-tooth and cast-for-age production and gross profitability would be even less significant than they are in the table; they are virtually in balance.

Before I set to work on this paper I had never formed any definite opinion as to whether 2-tooth or cast-for-age buying was the more economical or profitable. I am now still in the same open frame of mind. I cannot see much in it either way. It seems a matter of choice, subject to husbandry factors and a reasonable level of market differential between young and old ewes.

Personally, purely on the basis of farm husbandry I would choose the old ewe, but perhaps I am old fashioned.

Radio Broadcasts to Farmers

RADIO broadcasts to farmers will be given during November as follows:

1YA Auckland, 7.45 p.m.

5 November—"Biting Flies in Dairy Cattle", by A. Fisher, Veterinarian, Department of Agriculture, Papakura.

12 November—"Water Supply", by J. L. Doutre, Machinery Instructor, Department of Agriculture, Auckland.

19 November—"Town Milk Production", by N. Harrison, Livestock Instructor, Department of Agriculture, Auckland.

26 November—"Chemical Control of Weeds in Drains", by G. L. Banfield, Farm Advisory Officer, Department of Agriculture, Thames.

1XH Hamilton, 12.33 p.m.

9 November—"Stock Problems of the Month", by L. P. Wells, Livestock Instructor, Department of Agriculture, Hamilton.

16 November—"Chemical Methods of Drain Cleaning", by G. L. Banfield, Farm Advisory Officer, Department of Agriculture, Thames.

23 November—"Problems of the Month", by J. R. Murray, Farm Advisory Officer, Department of Agriculture, Hamilton.

30 November—"Management Accounting for Farmers", by J. M. Bottomley, Federated Farmers, Hamilton.

1YZ Rotorua, 7.15 p.m.

4 November—Young Farmers' Clubs, by Piako Y.F.C. district committee.

18 November—"Weed Control", by S. R. Hewitt, Farm Advisory Officer, Department of Agriculture, Whakatane.

2YZ Napier, 7.10 p.m.

3 November—"Haymaking and Management of Pastures", by H. J. Jagger, Fields Instructor, Department of Agriculture, Palmerston North.

17 November—"Practical Hints to Poultry Keepers", by H. K. Mullins, Poultry Instructor, Department of Agriculture, Hastings.

2ZA Palmerston North, 12.36 p.m.

9 November—"Soil Testing", by C. J. Christie, Farm Advisory Officer, Department of Agriculture, Palmerston North.

23 November—"Clubroot", by G. N. Paulin, Horticultural Instructor, Department of Agriculture, Palmerston North.

2XA Wanganui, 8 p.m.

5 November—"For the Country Woman", by Mary MacDonald.

19 November—"Good Management Prevents Many Pig Ailments", by C. M. Bailey, Supervisor, Taranaki District Pig Council.

26 November—"Livestock Notes", by J. F. Munting, Livestock Instructor, Department of Agriculture, Wanganui.

3YA Christchurch, 12.20 p.m.

7 December—"Pointers in Handling Certified Seed", by P. Barrer, Farm Advisory Officer, Department of Agriculture, Christchurch.

16 November—Review of "The New Zealand Journal of Agriculture", by E. G. Smith, Instructor in Agriculture, Department of Agriculture, Rangiora.

Regular Sessions

1YA Auckland, Mondays at 12.36 p.m. ("Country Journal", including "Report from Ruakura"), Tuesdays, Wednesdays, Thursdays, and Fridays at 7.45 p.m. ("Country Journal"), Thursdays at 12.33 p.m. ("News for the Farmer").

1XN Whangarei, Mondays at 8 p.m. ("Northland Stock Market Report" followed by "Farming for Profit"), Wednesdays at 8 p.m. ("Farming for Profit"), and Fridays at 12.33 p.m. ("Farm News").

1XH Hamilton, Mondays at 12.36 p.m. ("For the Farmer", excluding first Monday in month and public holidays), Wednesdays at 12.33 p.m. ("Report from Ruakura").

1YZ Rotorua, Wednesdays at 7 p.m. ("Bay of Plenty Journal"), Thursdays, 12.33 p.m. ("News for the Farmer").

2YZ Napier, Tuesdays at 7.10 p.m. ("The Hawke's Bay Farmer") and Thursdays at 12.33 p.m. ("News for the Farmer").

2XG Gisborne, Tuesdays at 8 p.m. ("Farm Session").

2XP New Plymouth, Thursdays at 8 p.m. ("Farm Session").

2XA Wanganui, Mondays at 8 p.m. ("For the Man on the Land"), Tuesdays at 8 p.m. ("Farm Supplement"), and Thursdays at 8 p.m. ("Farm Topics").

2XB Masterton, Fridays at 6.45 p.m. ("Farm Session").

2XN Nelson, Thursdays at 8 p.m. ("Nelson Farm Topics").

2ZA Palmerston North, Mondays at 12.36 p.m. ("Country Digest") and Fridays at 8.30 p.m. ("Country Digest", including Feilding stock market report).

2YA Wellington, Mondays, Tuesdays, and Fridays at 7.10 p.m. ("Farm Session"), Thursdays at 12.33 p.m. ("News for the Farmer").

3YA Christchurch, Mondays at 12.20 p.m. ("Country Session"), Thursdays at 12.33 p.m. ("News for the Farmer"), and 7.10 p.m. ("Home Paddock").

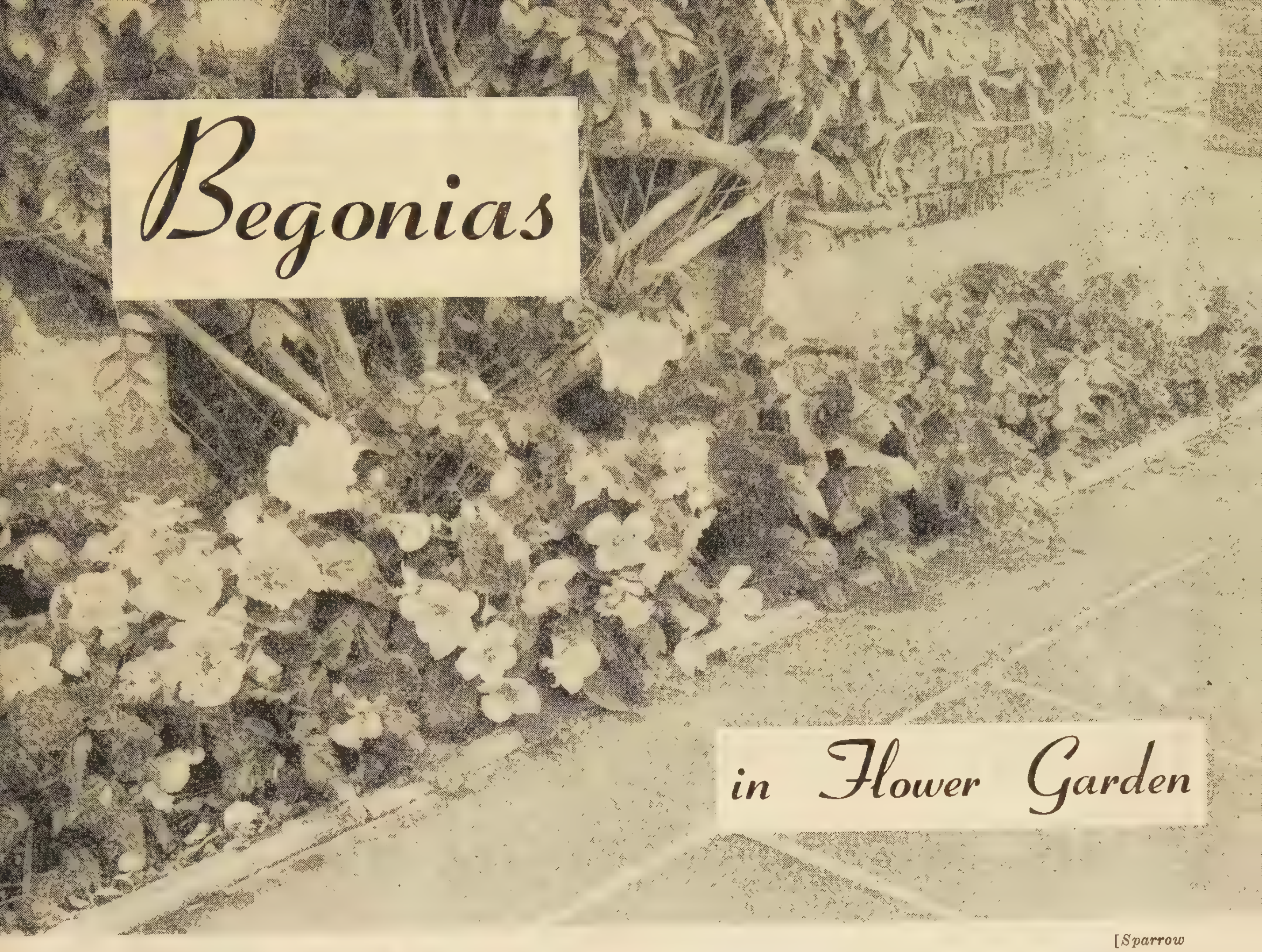
3XC Timaru, Wednesdays at 8 p.m. ("Farmers' Weekly News Service") and Saturdays at 10.30 a.m. ("Country Mailbag").

3YZ Greymouth, Mondays at 12.36 p.m., Thursdays at 12.33 p.m. ("News for the Farmer").

4YA Dunedin, Mondays at 12.36 p.m., Wednesdays at 12.33 p.m., and Thursdays at 12.33 p.m.

4YZ Invercargill, Mondays at 12.36 p.m., Wednesdays at 12.33 p.m., and Thursdays at 12.33 p.m. ("News for the Farmer").

Begonias in Flower Garden



[*Sparrow*

▲ Tuberous begonias are good bedding plants for a cool, sheltered semi-shaded bed.

By J. S. SAY,

Horticulturist,

Department of Agriculture,

Auckland

MASS displays of tuberous begonias growing in pots and hanging baskets are the main feature in the glasshouses of many public and private gardens during summer. Their perfect shape and delicate texture combined with a wonderful range of colours make them one of the most popular of pot plants. In addition to the large-flowered tuberous begonias there are a number of other flowering types suitable for glasshouse, garden, and indoor decoration which are not so well known. Two in particular are well worth growing, *Begonia multiflora*, which flowers in the summer, and *Begonia* Gloire de Lorraine, which will make a bright show during the early winter.

Tuberous Begonias

TUBEROUS begonias can be grown to perfection in a glasshouse, sun-porch, or on a sheltered veranda. A very sheltered lath house or shade house makes a suitable home for them in many districts and they make good bedding plants in a favourable corner in the open ground. They are not entirely satisfactory as house plants, as they sometimes do not flower freely.

Propagation

Tuberous begonias may be propagated by seeds or cuttings. Anyone who has not grown tuberous begonias before would be advised to start with bought tubers, for seeds are a little difficult, especially without a glasshouse or frame. Division of old tubers is also possible, but not generally recommended.

Seed

As the seed is extremely fine and the young seedlings are very small and difficult to handle, some skill and good facilities are needed to be really successful with this method.

Seed may be sown any time from late winter in a glasshouse (heated in cold districts) to November or December. Early and mid-season sowing will produce good plants which will flower during summer and early autumn, but late sowings are unlikely to give any flowers. Some specialist growers sow in late autumn, but this is not generally recommended, as overwintering the small plants is a problem.

A John Innes seed sowing compost consisting of 2 parts of soil, 1 part of sand, and 1 part of leafmould (or peat or good compost), with the addition of 1½ oz of superphosphate and ¾ oz of lime per bushel, is suitable, though

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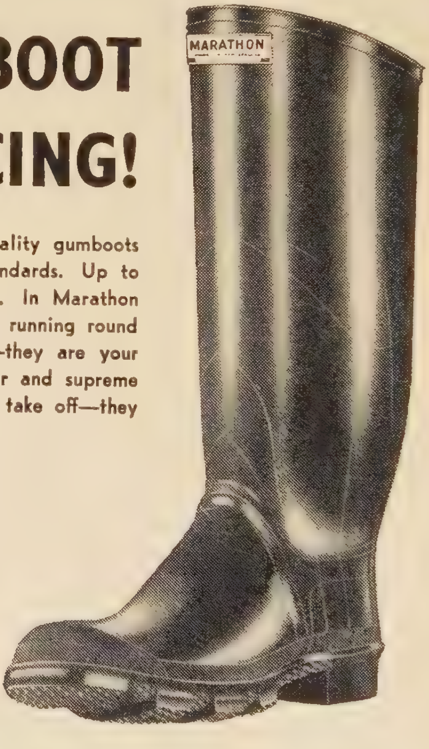

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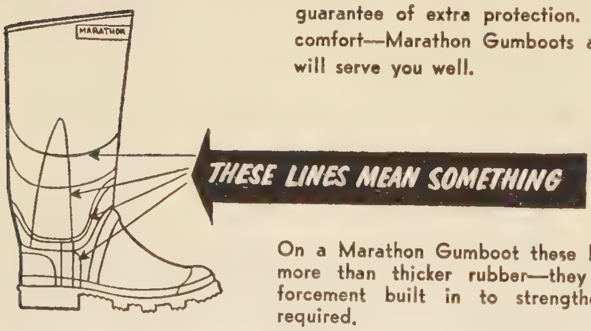

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some prefer other mixtures. Mixtures of equal parts of soil and sand and one or 2 parts of leafmould and 1 part of sand have given good results. The soil should be sterilised if possible for disease and weed control. Compost can introduce many weed seeds which germinate and grow much more rapidly than the begonias, and it is better avoided if leafmould or peat can be obtained.

The ingredients should be put through a ¼ in. sieve and thoroughly mixed. The mixture should be lightly firmed in the seed tray or pot and, after the surface has been made level, it should be topped off with some of the mixture through a very fine sieve. The seed should be sown thinly and not covered with soil. The box or pot should be covered with glass and paper. As the seed is very easily washed away, watering is better done by soaking the box in water, unless a can with a very fine rose is used. When the seeds germinate lift the glass and paper an inch or so and remove after a few days. Some shading on the glasshouse or frame will be necessary in spring and summer. As much air as possible should be given, because moist, stagnant conditions encourage fungi which cause damping off and rotting.

The seedlings are very small, making them difficult to handle, but they should be pricked out into other boxes about 2 in. apart as soon as possible. They are often easier to handle with a stick with a small V cut in the end than with the fingers. Whatever system is used the seedlings should be treated gently. The seed sowing mixture can be used, but the fertilisers can be increased to 1½ oz of superphosphate, 1½ oz of blood and bone, ¾ oz of potash, and ¾ oz of lime per bushel.

When about 3 in. high the seedlings will be ready for potting up into 3 in. or 4 in. pots and later they will have to be potted on to larger ones or flowering. Early sowings will probably reach 7 in. or 8 in. pot size. A John Innes potting mixture is suitable. It consists of 7 parts of soil, 3 parts of leafmould (peat or compost), and 2 parts of sand to which is added the fertilisers mentioned above for pricking out.

Many growers prefer a lighter and more open mixture made by adding 1 or 2 extra parts of leafmould and sand. The addition of some well rotted animal manure (cow, horse, or sheep) is favoured by many growers.

Cuttings

Cuttings, made from the shoots arising from the tubers when they break into growth, root easily. They are usually made when the shoots are about 2 to 3 in. long and are rooted in sand or a mixture of sand and leafmould. If cuttings are taken very early, bottom heat is of great assistance, but later they can be rooted under normal glasshouse or frame conditions. After rooting they should be potted up into 3 in. or 4 in. pots in the mixture given for seedlings and later into larger pots.

Starting Tubers

Tubers may be started into growth in late winter if a glasshouse is used (heated in cold districts) or left until spring or early summer. It is not advisable to start them too early unless adequate facilities are available. The flowering season can be extended by starting some tubers early and others later. Where cuttings are required it is as well to start the tubers as early as practicable to give the cuttings a long season to develop, flower, and make a tuber.

A mixture of equal parts of sieved leafmould and sand makes a good medium. It should be moist but not wet. The mixture is put in a shallow box, lightly firmed, and the tubers pushed down into it and then just covered with more of the mixture. The box should be put in a warm place, but if heat is used it should not be forcing, or weak sappy growth will result. Sometimes it is difficult to tell the top of the tubers from the bottom. The top is usually concave. If any tubers appear to be slow in breaking into growth, they should be lifted and examined, for they may have been set upside down. Before tubers are put into the mixture they should be carefully examined. Rotted parts should be cut out and the cut surface dusted with sulphur.

Roots usually do not start to grow until the top growth is well advanced. The tubers should not be potted up until they have a mass of well developed roots. Except for basket varieties only one shoot should be allowed to develop on small tubers, but two or three may be left on three- or four-year-olds. In general the finest flowers are produced by one- or two-year-old tubers with a single stem. The other shoots can be used as cuttings if required. If not, they should be rubbed off as soon as they begin to grow.

For potting up rooted tubers some gardeners believe in potting into small pots (4 in. or 5 in.) and then potting on into 6 in., 7 in., or 8 in. as required; others pot direct into large pots. Both methods are satisfactory. The former has the advantage of taking up less room for a month or so, but means double handling; the latter requires a little more care in watering, but is a great time saver. When potting the top of the tuber should be very slightly below the soil level.

Culture

The culture of plants from seed, cuttings, or tubers is the same once they have been potted up. High temperatures should be avoided, the most satisfactory range being about 50 to 70 degrees F. Where heat is used early in the season it should not be forcing. In summer begonias need plenty of ventilation and some shade. Too heavy shade, especially with high temperatures, will promote a soft, sappy growth which is very liable to disease and will also have an adverse effect on flowering.

[*Welsh*

Tuberous begonias are the most popular of summer flowering pot plants and are not difficult to grow.

Watering should be done with care. Water thoroughly and then leave until the pots show signs of dryness. A pot in need of water will give a ringing sound when struck sharply with the knuckles or a small wooden mallet. When wet it gives a dull sound.

Staking is always necessary and should be done at an early stage. Thin bamboo canes make good stakes and are inconspicuous. A thin wire bent into the shape of a Y with a very long tail is useful for propping up the flowers when necessary.

Until the plants are well developed remove the flower buds as they appear. The first few flowers produced by immature plants are usually small and their loss is more than compensated by increased vigour of the plants and better flowers later. Disbudding can regulate the time of flowering and can be done where a mass display is required at a certain time. The two small female flowers borne on either side of the large showy male flower

T1.9A

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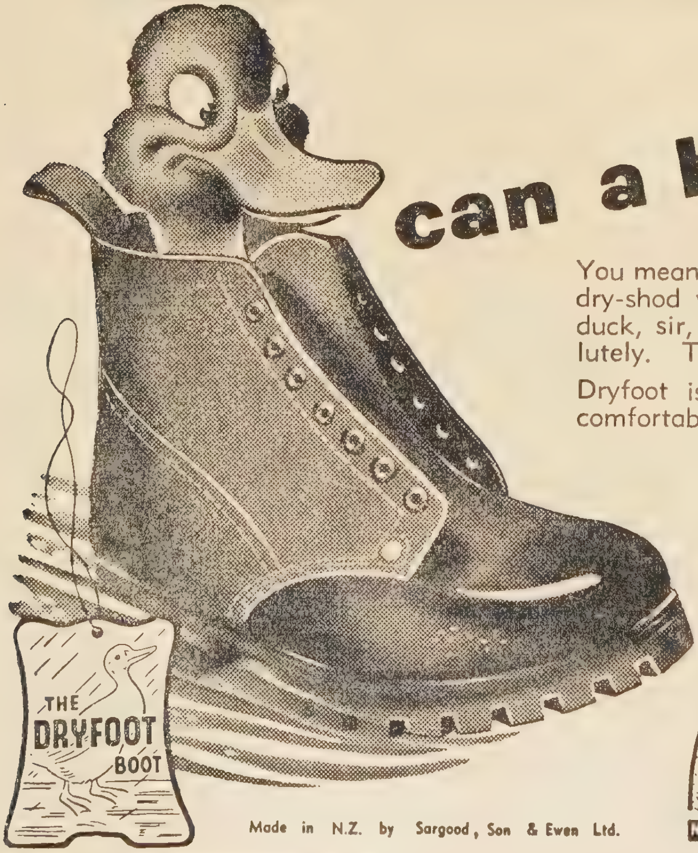

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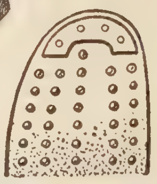
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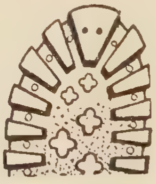
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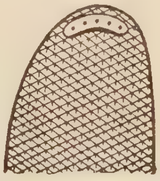
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should be removed. Old flowers should be removed as they fade and not be allowed to drop and rot on the soil or leaves, as the fungus attacking them will soon spread to the stem and leaves.

Light applications of liquid manure can be given as they come into flower if the plants are pot bound. Overfeeding will induce weak growth which will not hold the flowers up well and which is very liable to disease.

Plants have to be dried off after flowering by gradually reduced watering. It should not be stopped suddenly. As soon as the tops have dried off completely the tubers can be knocked out of the pots and shaken free of soil, dusted with thiram, and put into winter storage.

A great many tubers are lost during the storage period. If kept too wet, they are liable to rot or start into growth before needed. If too dry and warm, they shrivel and die. They may be spread out in shallow boxes or partly buried in dry sand, perlite, leafmould, or peat and placed in a well ventilated, cool, darkened position.

Examination at fairly frequent intervals is advisable so that any trouble can be checked before it becomes serious. Some growers leave the tubers in the soil in the pots laid on their sides in a dry position. Though this works well, it has the disadvantage that the tubers cannot be examined easily.

Shade House Culture

Especially in the warmer districts tuberous begonias can be grown well in lath or shade houses. Growth is usually much sturdier than in glasshouses, for the plants seem to like the cooler, airy position. They should not be started into growth too early, for late frosts can do much damage. Another big problem is wind. Firm staking is essential and if possible the pots themselves should be plunged or secured in some other way to prevent them from blowing over. Polythene lining on the windward side is a help, but it is usually an unexpected wind from another quarter that does the most damage.

Outdoor Culture

Tuberous begonias in the right spot will make a wonderful show in the garden. A position completely sheltered from wind and receiving dappled shade from trees is ideal. Plenty of leafmould and well rotted manure worked into the soil will give good drainage and a cool, moist root run. For best results the plants should be well established in pots and then hardened off before planting out.

As House Plants

Tuberous begonias are frequently not satisfactory for indoor decoration. Unless they are in a room which receives plenty of light, they are likely to be weak and drawn and will not flower, but they should not be put in direct sun. Plants brought into the house when in full flower often drop their flowers almost immediately and do not bear any more. This is caused by the rapid change of conditions, for example from a glasshouse to the poorer light and drier conditions of a room. Other than placing them in the best possible position little can be done to bring them into flower again. They should not be fed with liquid manures or be watered too much or too often, as this is more likely to add to the trouble.

Basket Begonias

Basket begonias are pendulous forms of tuberous begonias and treatment is almost identical. The only differences are that several shoots can be left on each tuber and the female flowers need not be removed, as the maximum display of colour is needed rather than perfection of individual flowers. Best results will be obtained if the tubers are started up in the usual way and then potted into 4 in. or 5 in. pots. Once they have become well established and are growing strongly they can be put into baskets. Three plants spaced round the basket will give quicker and far better coverage.

Begonia multiflora

Begonia multiflora is a tuberous type with a dwarf bushy habit and during summer produces masses of flowers similar to but much smaller than the larger-flowered tuberous varieties. There is a good range of colours in singles and doubles. As they are hybrids, propagation from seed is not satisfactory, but they can be raised easily from cuttings in the same way as large-flowered tuberous begonias.

They make good bedding and edging plants and will stand sunnier and more exposed positions than the large type.

↓ Multiflora begonias make a colourful display in the garden. They stand sunnier and more exposed conditions than large-flowered tuberous begonias and can be used for beds, edging, and window boxes.

[*Sparrow*

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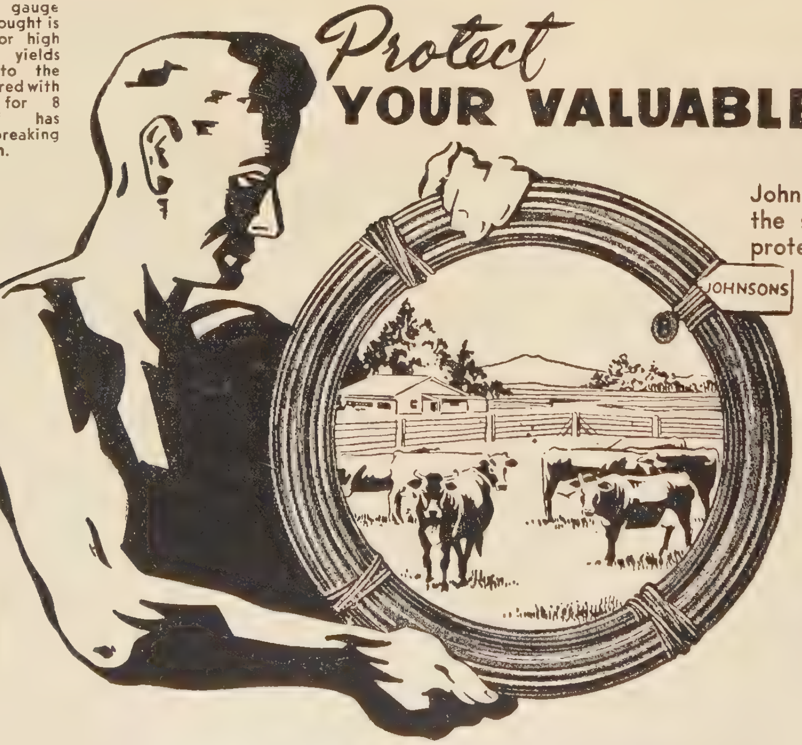

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Culture is the same as for tuberous begonias, but many shoots may be left to each tuber and no disbudding is needed.

Gloire de Lorraine Begonias

The winter-flowering Gloire de Lorraine begonias are comparatively little known in New Zealand. They have thin, wiry stems, a compact bushy habit of growth, and when well grown are completely smothered in small flowers in late autumn and early winter. The variety Gloire de Lorraine from which the group takes its name has pink flowers and is the one most frequently seen. Other varieties have white, deep pink, and carmine flowers. The leaves are almost circular, shining, and are usually pale green except in some varieties which have a reddish tinge.

As Gloire de Lorraine begonias are infertile hybrids, they can be propagated only by vegetative means. Ordinary stem cuttings or leaf cuttings may be used. They are usually taken soon after flowering is finished in late winter or may be left until early spring and are rooted in sand or a mixture of sand and leafmould. Unless bottom heat is available, rooting may not be satisfactory, especially if the cuttings are taken early.

Leaf cuttings usually make the best plants. The leaves should be cut off with an inch or more of leaf stem. The new plant rises from the base of the stem and not from the leaf as in Rex begonias. The stem should be inserted into the rooting medium to about half its length. After rooting they can be potted up into 3 in. pots, but potting should not be done until the shoot has also developed. The potting compost recommended for tuberous begonias is suitable.

During summer they require some shade, moderate temperatures, and not too much water. To keep them growing strongly a little liquid feed may be given, but overfeeding will cause weak sappy growth. By late autumn they should be in the pots in which they will flower. A well grown plant will fill a 7 in. or 8 in. pot or pan. The new shallow pots make excellent containers. Staking is usually necessary and the best way is to insert some very thin canes round the edge of the pot and tie them together to form a low cone. This will hold the plant up with the minimum of tying and it will form a dense, compact mass. Heat in late autumn-winter is desirable in all but the warmest districts. A minimum winter temperature of 50 to 55 degrees F is required.

After flowering they should be cut back to about half their height and watering reduced, but they should not be dried off. The stems and leaves removed may be used as cuttings, but better stem cuttings will be obtained from the young growths in spring. When growth begins the old plants will need repotting. Plants are not usually worth keeping after three years, the best display being given by plants in their second year.

Other Species

A little-known summer-flowering kind which is sometimes available is the hollyhock begonia. There is a little doubt about its correct name. It is usually known as *B. martiana* or *B. gracilis martiana.* Other similar varieties with which it could be confused are *B. gracilis annulata* and *B. gracilis diversifolia.*

[Welsh

No glasshouse display of tuberous begonias is complete without some baskets of pendulous varieties.

It is a tuberous kind which produces a single upright stem 2 to 3 ft high. The pink flowers about 1 in. across are clustered all the way up the stem, hence its common name, and are borne for about three months. Culture is the same as for ordinary tuberous begonias. This group of begonias has the peculiar habit of producing clusters of six to 12 small tubers about 1/16 in. diameter in the axils of the leaves after flowering. These can be sown like seeds in winter in a heated glasshouse or in spring.

Another seldom seen species which is useful for glasshouse decoration in late autumn-early winter is *B. froebeli.* It grows to about 12 in. with large hairy leaves and loose drooping heads of bright scarlet flowers about 1 in. across. It is a tuberous species which is more or less dormant in summer. It is sometimes treated like an annual, for it grows readily from seed and will flower in one season.

The many varieties of fibrous rooted *B. semperflorens* are well known and used extensively as summer-bedding plants. Not so well known but becoming very popular are the double forms. The pink variety Gustav Lund or Westport Beauty has been available for some years and several other colours have recently been put on the market. They are just as easy to grow as the ordinary bedding types and can be used in the open garden or as pot plants in the glasshouse or indoors. They flower most of the year round in frost-free areas or under glass. In cold areas they need winter protection. They are easily propagated by cuttings taken at almost any time of the year or by dividing old clumps.

Many other begonias grown primarily for their foliage also produce showy and attractive flowers. A number of these were described in an article in the December 1958 issue of "The Journal".

Pests and Diseases

Begonias are relatively free of serious pests and diseases. Rotting of stems and leaves of tuberous kinds can be serious where growing conditions are not good. At the seed-box stage overcrowding, overwatering, and too humid atmosphere make the young seedlings very susceptible to damping off. Later, high temperatures, humid conditions, too much shade, and poor ventilation cause a soft growth readily attacked by stem and leaf rotting fungi, particularly botrytis. Good growing conditions and hygiene are the best preventives. Thiram will help to control all these fungus diseases, but will not cure them.

Cyclamen mites sometimes are a serious pest. They are very small and can barely be seen with the naked eye. They cause serious distortion of the leaves and growing tips. Malathion is the best control. Mealy bugs and white flies may be controlled with DDT and aphids by nicotine sulphate.

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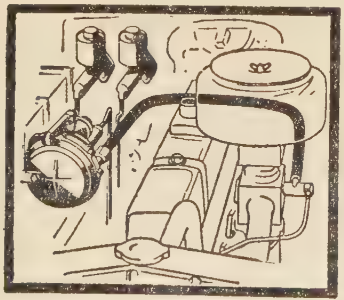

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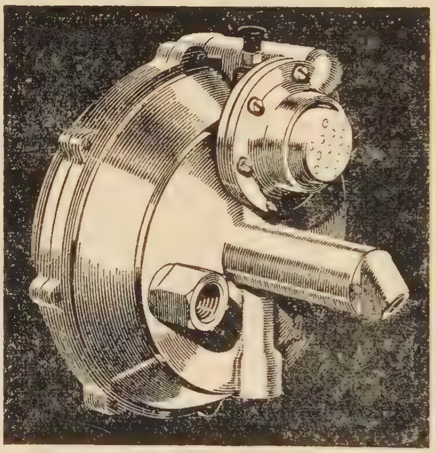

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Work for November . . . FLOWER GARDEN

Staking of plants should be included among the tasks to be attended to in November, with the possibility of seasonal gales.

Staking should be done as plants develop. The ultimate height of most plants is known and they should be staked accordingly. Plants are growing quickly at this season and will soon hide the stake. Durable metal stakes are now available. If shallow-rooted plants such as banksias, leucodendrons, proteas, dryandras, and flowering crab apples on dwarf rootstocks were not staked at planting, they should be attended to. Dahlias are best staked at planting so that the tubers are not damaged when the stake is inserted. Twiggy pieces of bamboo can be used among clumps of geums, potentillias, and other sprawling plants to give unobtrusive support.

Climbing Plants

Supports should be provided without delay for all climbing plants. Climbers are often planted to help screen paling fences. For lighter types of climbers plastic coated flex can be strung against the woodwork. At the base of some wooden fences a space is sometimes left so that the bottom wood does not rot through contact with the soil. A draught through such a gap is often damaging to young plants, and boards placed along the gap, at least until the plants become established, will be worth while.

Strong-growing climbers such as vitis, or *Celastrus scandens*, should be tied in as they develop, especially in windy areas. Seed of some climbers, including *Cobea scandens*, ipomea (morning glory), and *Mina lobata* can be sown in warm positions to give quick cover. Ipomea seed should be soaked in water for a day before planting.

By ROSALIE A. CAMPION,
Horticultural Instructor,
Department of Agriculture,
Wellington

Seedlings

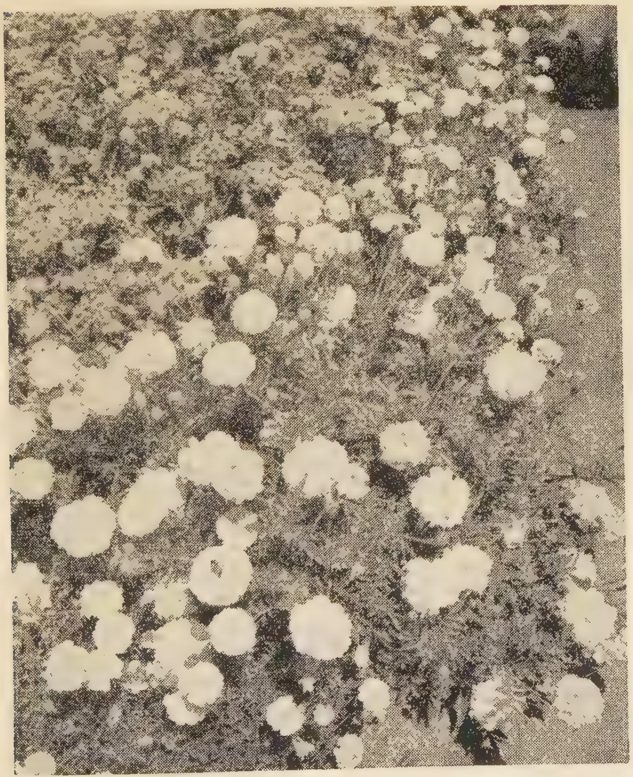
In flower borders gaps can be worked to a fine tilth for sowing the seed of annuals, which develop quickly. Seed sown earlier should be thinned out to give the plants a chance to develop. Thinnings could be transplanted into other gaps. In the back of the border seed of helianthus (sunflowers), helichrysum (everlasting daisies), and ricinus (castor oil plant) can be sown early this month to fill the gaps quickly. Calendulas if sown now could be used to fill gaps which appear in January.

Wallflowers, anemones, polyanthus, sweet williams, and biennials including Canterbury bells can now be sown in boxes to germinate and develop for flowering next spring and summer.

Flower Arrangement

Several plants which are particularly useful for cutting and use in flower arrangements can be raised from seed sown at this time. Ornamental gourds can be sown as a ground cover among shrubs on a sunny bank. Seedlings of ornamental crimson beet can be pricked out early and look well as a sunny border plant alternated with the grey leaved *Centaurea candidissima*. Molucella (bells of Ireland) is often better if sown thinly where it is to flower. *Euphorbia marginata* (snow on the mountain) can also be broadcast in the open ground. If left, this plant will reseed itself each season. Ornamental kale and corn can also be sown.

The perennial plant *Physalis franchetti* has bright orange calyces persisting throughout winter and can



[*Elliott*

French marigolds as a border in front of ageratum blend harmoniously in complementary colours.

[*Sparrow*

Seedlings should be thinned out early to allow room for good development. The thinnings could be planted elsewhere.

[Elliott

Clematis jackmani, one of the varieties which flowers at this time of the year and which should have an adequate trellis over which to climb.

be grown from seed sown now. It develops a widespread root system which may affect other plants.

Bedding Plants

If it is not possible to plant out boxed seedlings before the roots have filled the soil in the boxes, they should be given weak liquid feed; otherwise they will become yellow and starved.

The day before plants are set out the boxes should be well watered so that the leaves are turgid and better able to stand transplanting. The soil will also adhere to the roots. If the bed is dry, it should be soaked a day or two before planting out or immediately after. If hot weather occurs and the plants droop, a light hosing could be given in the evenings as well. Contrasting colour schemes such as orange marigolds with blue ageratum, *Verbena venosa* among pale African marigolds, or bright red geraniums set against their background of dark green foliage make dramatic yet harmonious bedding schemes. Very closely related colour schemes have a more restful effect and could be used in secluded areas.

Bulbous Plants

The corms of cyclamen in pots should be given less water over summer, but should not be dried off completely. Old pot plants can be placed on their side and on the cool side of the house. Young cyclamen seedlings can be pricked off into pots and should be kept growing over summer.

Narcissus bulbs can be lifted every third year as the foliage fades. As a precaution soak all bulbs for 10 minutes immediately after lifting in aldrin emulsion at 4 oz to 2½ gallons of water. Experiments have shown that this will kill any bulb fly which may be present and protect the bulb for the season. Bulbs should then be dried off quickly in a warm but sunless place outdoors.

Cannas, crinums, sprekelias, clivias, and tigridia bulbs should all be planted as soon as possible.

Anemones and Freesias

Anemones and freesias can both be grown from seed sown at this time of the year. To obtain early flowers it is probably better to use small corms of anemones and these could be planted 2 in. deep. If cloches are available, the corms should be planted in double rows and covered in April for flowering in June-July.

Freesias grown from seed are usually free of disease. The seed will germinate more easily by rubbing in sand to remove the oily coating. This allows the entry of moisture. The seed should then be mixed with moist sand and kept in a warm dark place. If placed in a glass jar, it is possible to see the white sprouts appear in about a month's time, when the germinating seed can then be sown thinly in boxes.

Dahlias and Chrysanthemums

Dahlias can be planted now in all districts. In the milder districts dahlias which have been left overwinter in the ground will be shooting. If it is not desired to increase the planting by division, the shoots on vigorous plants should be thinned down to three or four as early as possible. A dressing of 4 oz of mixed fertiliser to each plant can now be given. A mixture of 3 parts of blood and bone, 2 parts of superphosphate, and 1 part of potash would be suitable for both dahlias and chrysanthemums.

Rooted cuttings of chrysanthemums can be planted out early this month. Here again, thinning of shoots from established clumps is desirable. The remaining growths should have the top of the stem removed when they reach 8 in. and again when a further 6 in. of growth has been made. The clumps should be kept growing healthily so that they are less likely to succumb to pests and diseases.

Insect Pests

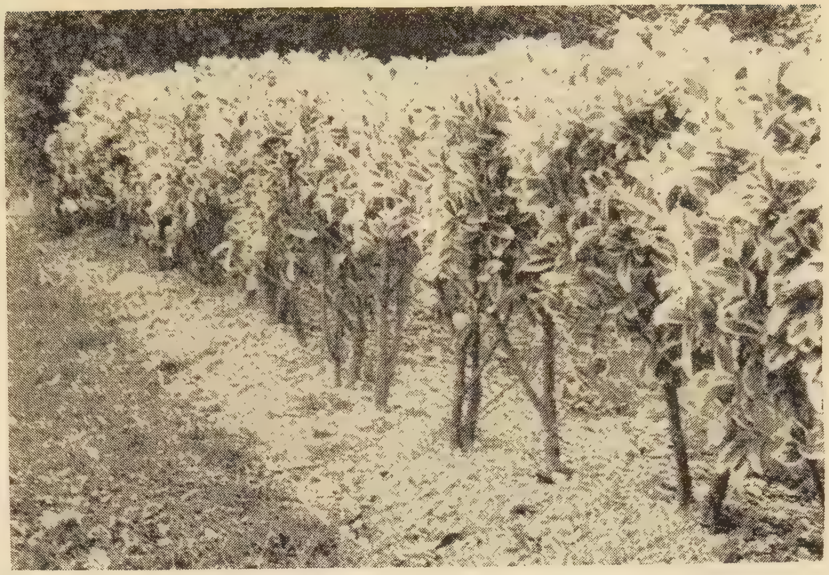
Springtails, which are lively greyish-white insects, can damage germinating seedlings and in damp conditions where plants like sweet william lie close to the ground they are often associated with the rotting of plants. Where this is so decaying matter should be removed and the soil area watered with 1 teaspoon of nicotine sulphate to 1 gallon of water to which soft soap has been added. Aldrin at 1 oz to 120 sq. yd. or lindane 25 per cent wettable powder at 1 oz to 4 gallons of water could also be used.

Grass grub beetles will be flying in the evenings now and feeding especially on foliage of deciduous shrubs. These beetles lay their eggs in the soil and the young larvae hatch out in two to three weeks and begin eating the young roots of many plants. Soil which has been treated with 50 per cent DDT at 1 oz to 40 sq. yd. will not allow these pests to become established. Flower beds as well as lawns should be treated every second year when fertilisers are applied.

Thrips can also cause damage by sucking the sap from many plants and causing a silvering effect. Escallonia, rhododendrons, lauristinus, and citrus are often attacked and DDT, lindane, or malathion in emulsion forms could be used as a spray.

Pruning

Spring-flowering shrubs such as *Erica parkeri*, *Erica* Dawn, *Olearia*



A two-year-old hedge of *Euonymus japonica variegata* which has become bare at the base because it was not pruned during the first season of growth to encourage it to thicken out.

gunniana Blue Gem, prostanthera, lilac, weigela, and early brooms can now be pruned. As the flowers fade, flowering branches should be cut back to two to three buds. This removal of seed heads is also an important factor in increasing the life of South African flowering plants such as proteas.

Hedges should be clipped now and the refuse composted. It is especially important to trim newly planted hedges; otherwise they become leggy and bare at the base. It is difficult to encourage growth lower down later. Artemisia is a grey-foliaged plant which makes an attractive quick-growing hedge. It should be clipped every two months over the growing season.

Roses

For show roses side shoots should be disbudded early, as soon as the buds grow apart. Such close examination of the buds will usually reveal any insects. A combination spray or dust should be applied throughout the season and the following are suitable:

Dust

10 parts of 1 per cent or 2 per cent lindane dust
9 parts of flowers of sulphur
1 part of 50 per cent thiram or captan

Spray

1 oz of captan or thiram 50 per cent
¾ oz of colloidal sulphur 75 per cent powder
¾ oz of malathion powder
4 gallons of water

It is unwise to use the emulsion forms of sprays, as they have been known to cause damage to young growths. These mixtures are planned to kill insects already present and to prevent any damage from fungus diseases. To prevent disease it is necessary to spray or dust regularly every two weeks or after heavy rain.

Lawns

In young lawns, especially those which were sown with little soil preparation, weeds often come away strongly. An application of hormone weedkillers followed immediately by fertilisers will kill most weeds. On young lawns 1 fl. oz. of the potassium salt of MCPA should be mixed with water and spread over 100 sq. yd.

This should be followed by 1 oz per sq. yd. of a mixture of 3 parts of sulphate of ammonia to 1 part of superphosphate, a dressing which should be repeated quarterly. Grass grubs should also be controlled and this subject is dealt with under the section Insect Pests.

General

Regularly weed flower beds. Weeds will be making rapid growth now and could rapidly outgrow some desirable plants.

Mulches should be used liberally round most shrubs and especially surface-rooting ones like camellia, hydrangea, rhododendron, and azalea. Mulching with sawdust can be used to control weeds in shrubberies and among bulbs. Nitrogen in the form of blood and bone or sulphate of ammonia should be applied at the same time.

Flower heads should be removed as they fade to prolong the flowering season. Healthy material should be composted.

Poor plants should be replaced where possible. If growth is distorted or streaked, the plant may be affected by a virus and should be burnt. Aubrietia, marguerite daisy, and perennial wallflower sometimes become straggly. They should be trimmed back now to encourage young growth.

Gladiolus should be staked as they develop. Bamboo canes are very suitable. Any plants which wilt or yellow should be dug out and burnt. Bulbs not yet planted should be dipped in Aretan at 1½ oz to 4 gallons of water for 30 to 60 minutes before planting for autumn flowers.

Pot plants should be turned occasionally to prevent them becoming lopsided. They should not be overfed with nitrogenous fertilisers or they may become sappy in growth and produce few flowers.

If the ground is becoming very dry, trees and shrubs planted this season will benefit from a good soaking with the hose and then by a mulch.

In the Glasshouse

Most summer-flowering subjects in the glasshouse are beginning to make their display. Attention should be paid to ventilation, watering, and feeding to bring the plants to perfection.

Temperatures should be kept as even as possible.

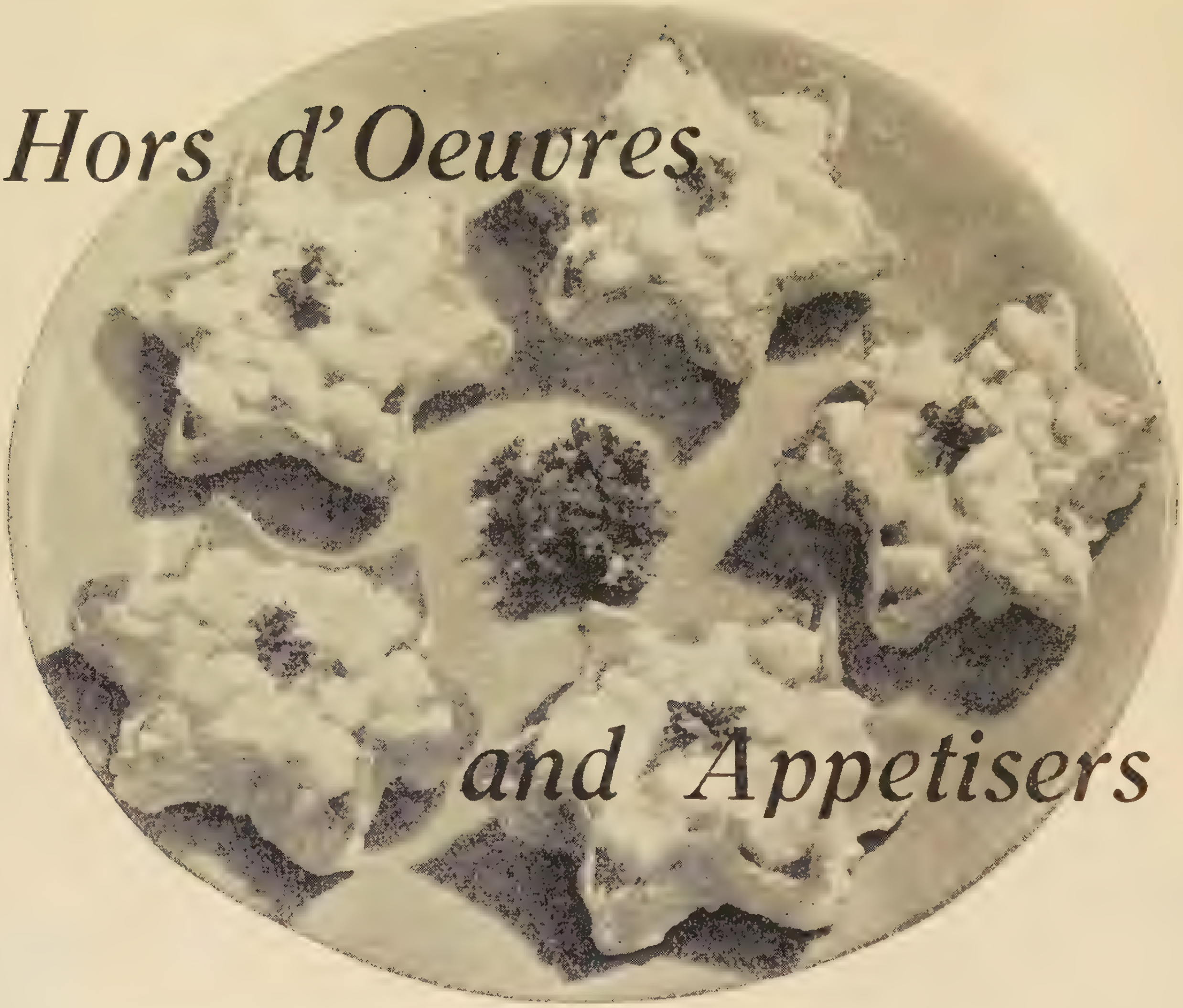
During hot weather houses should be damped down several times a day to prevent a dry, hot atmosphere which encourages the increase of many plant pests.

Fuchsias and begonias are two plants which grow well together, as both require shade. Fuchsias should not be placed in too large a pot, but benefit from liquid feeding. Begonias should be potted on as the roots fill the pots. The roots of well grown plants will usually fill a 7 in. pot eventually.

Seed of *Primula malacoides* and *P. sinensis* should be sown now to provide flowers next winter.

Plants such as crotons, palms, and asparagus which remain in the same sized pot for a long time will benefit from regular liquid feeding with 1 oz of sulphate of ammonia to a gallon of water.

Hors d'Oeuvres and Appetisers



HEADING PHOTOGRAPH: Special waffle irons were used to make the batter cases for the savoury corn.

WHEN an assortment of meats, fish, relishes, and other highly flavoured foods is served as a delicious overture to a meal the Americans call it appetisers, the French and English call it hors d'oeuvres, the Italians call it antipasto, and the Swedish call it smorgasbord. Regardless of their name, appetisers are all calculated, by their distinct and piquant flavour, as well as by their appearance, their careful arrangement, and their garnishing, to act as a stimulus to the most jaded appetite.

By JANET W. ROBERTS,
Home Science Instructor,
Department of Agriculture,
Auckland

HORS D'OEUVRES are often made of oddments of diced, cooked vegetables, fish, poultry or meat, seasoned with chopped parsley or chives, French dressing, or mayonnaise. In fact almost any meat, vegetable, or fish in small quantities may be served for hors d'oeuvres. It is an excellent way to use up small portions of tasty foodstuffs to make an extra course and they can be prepared well in advance of the mealtime.

Depending on their type hors d'oeuvres may be served at the table as the first course of a formal meal or they may be served with a cocktail or a sherry before a meal.

SINGLE ITEM HORS D'OEUVRES

Single item hors d'oeuvres are set on individual plates at each place at the table. They should be served with crisp rolls, toast, or brown bread and butter.

Oysters Rockefeller

4 oz of butter
1 cup of fine breadcrumbs
1 cup of cooked spinach
2 tablespoons of finely chopped onion
Salt and pepper
1 tablespoon of finely chopped parsley
1 tablespoon of dry sherry
2 dozen oysters in the half shell
4 oz of grated cheese

Cream the butter and mix in the breadcrumbs. Add the spinach, onion, parsley, and sherry and mix thoroughly. Season with salt and pepper. Spread the mixture generously over the top of each oyster in the half shell. Sprinkle with the grated cheese.

Place in a large baking pan and bake in a moderate oven at 400 degrees F for 10 minutes or until browned.

Serves eight.

Stuffed Mushrooms

20 mushroom caps
¼ cup of chopped mushroom stems
1 small, finely chopped onion
½ oz of butter
⅓ cup of fine, dry breadcrumbs
⅓ cup of chopped Brazil nuts
¼ cup of cooked tomatoes
2 oz of grated cheese
½ teaspoon of salt
⅛ teaspoon of pepper
2 teaspoons of lemon juice

Wash and dry the mushroom caps. Cook the mushroom stems and onion in butter slowly for five minutes (do not brown). Combine all the ingredients except the mushroom caps, mix well, and stuff the mixture into the caps.

Arrange them on a baking tray and grill for 10 to 15 minutes until browned on top.

Serves 10.

Melon Wedges

Melon
Ice
Icing sugar
Ground ginger

Chill the melon and cut it into wedge-shaped sections. Remove the seeds and if possible serve the wedges on ice with icing sugar and ground ginger.

Egg Mayonnaise

3 eggs
½ oz of gelatine
2 tablespoons of warm water
¼ pint of mayonnaise
1 tomato
1 lettuce

Hard boil the eggs, remove the shells, and cut the eggs in half lengthwise. Dissolve the gelatine in the warm water and add it to the mayonnaise. When the mayonnaise is on the point of setting coat each egg with the mixture.

When set place each half egg on a slice of tomato and arrange on a bed of lettuce.

Serves six.

Corn Savouries

Batter cases

8 oz of sifted flour
1 pint of milk
2 beaten eggs
1 teaspoon of salt

Mix into the beaten egg a spoonful of dry ingredients and a spoonful of milk alternately. The batter should be like thick cream. Leave it to stand for one hour before cooking.

Special irons are required to make the batter cases illustrated on page 394. The iron is dipped in hot fat which has a faint smoke rising from it, then into the batter mixture, and immediately back into the hot fat. Each case will take a few minutes to cook and it will leave the iron soon after it has been put back into the fat.

Filling

¼ cup of minced onion
2 cups of cooked whole kernel corn
½ teaspoon of salt
Pepper to taste
½ teaspoon of sugar
1 teaspoon of lemon juice
1 oz of butter

Cook the onion in butter until it is tender. Add the corn and other ingredients and heat them.

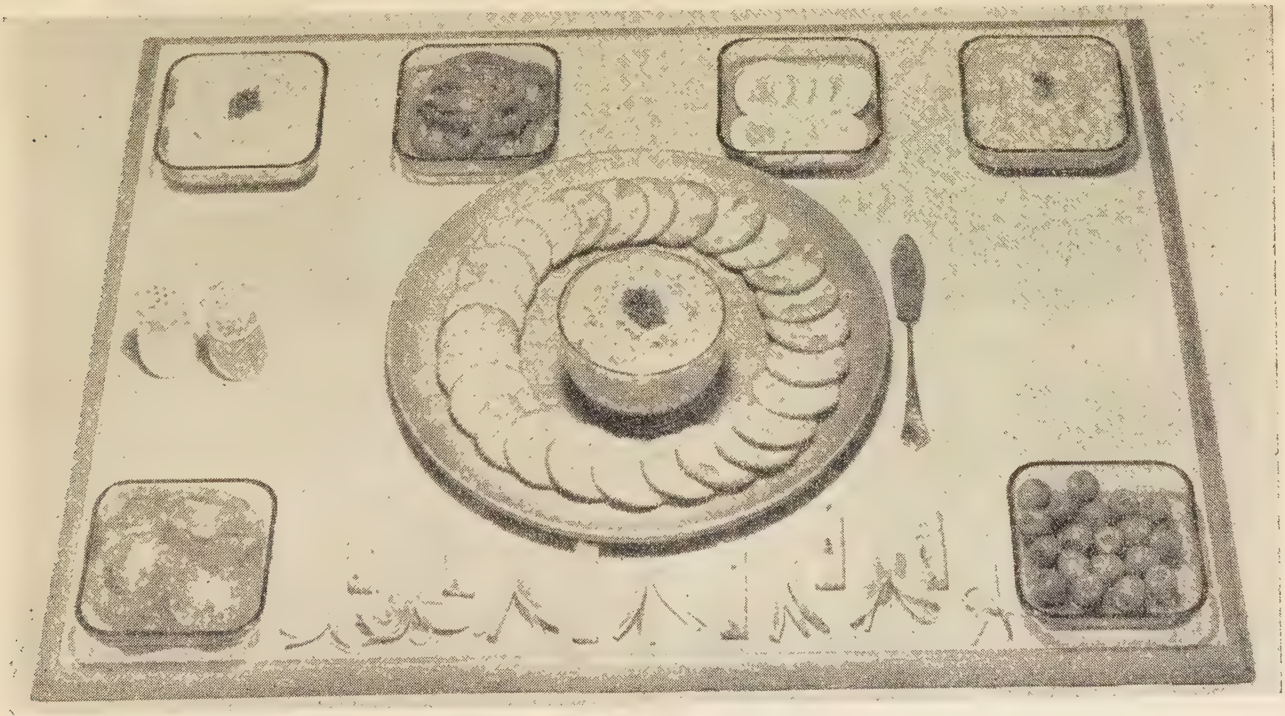
Put spoonfuls into each batter case and reheat in the oven.

Asparagus-ham Roll

1 tin of asparagus
4 slices of cooked ham
1 oz of butter
2 tablespoons of flour
¼ teaspoon of salt
⅛ teaspoon of pepper
½ pint of milk
4 oz of grated cheese

Melt the butter and stir in the flour and seasoning. Slowly add the milk and stir until the sauce thickens. Add the cheese and stir until it melts.

Roll four spears of asparagus in each slice of ham and place in a buttered dish. Cover with the cheese sauce.



A variety of foods can be prepared for serving with water crackers. Top, left to right: Cheese spread, green pepper slices, egg slices, corn spread. Middle: Salmon spread. Bottom, left to right: Tomato slices, celery sticks and curls for decorating, stuffed olives.

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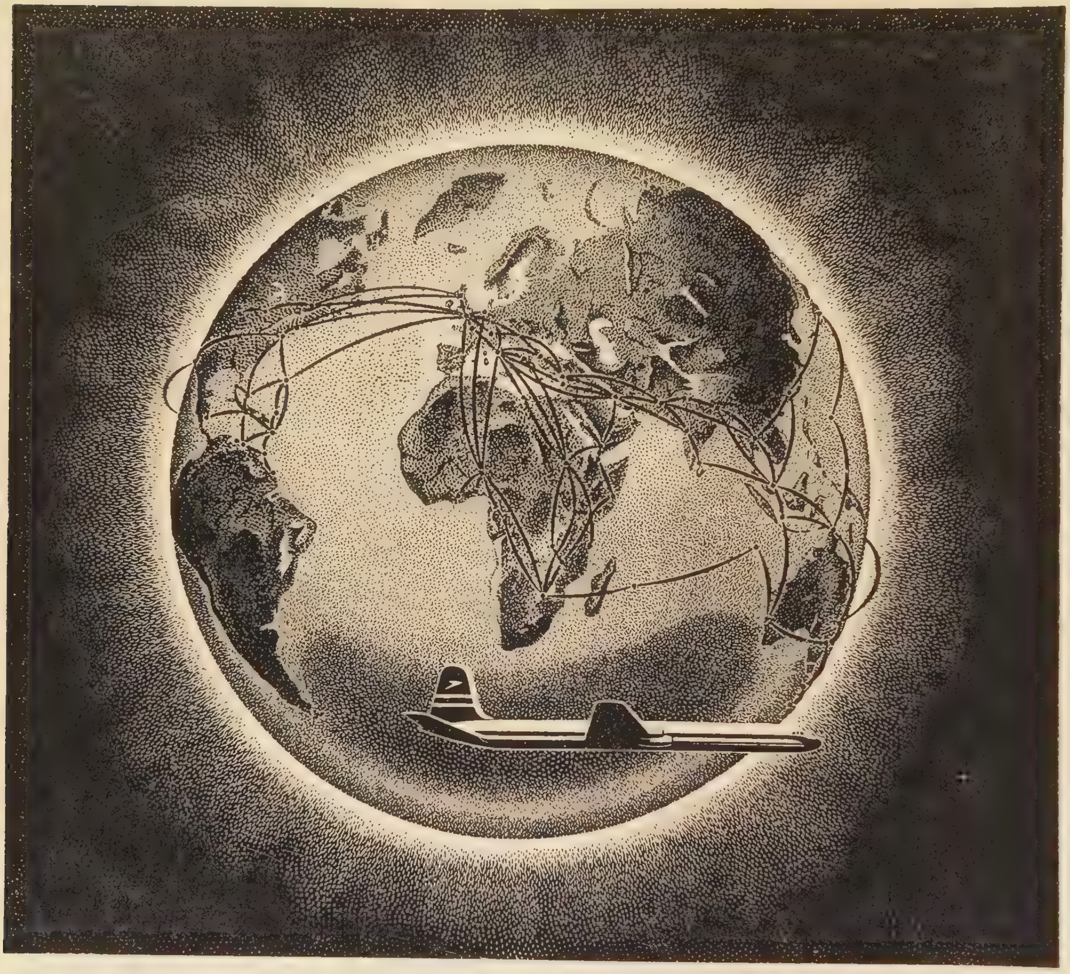

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Brown lightly in a moderate oven at 375 degrees F.

Serves four.

MIXED HORS D'OEUVRES

Special dishes, divided into sections fitted together on a round or oblong tray, are made for serving mixed hors d'oeuvres. Small separate dishes arranged on a tray or trolley may also be used or the food may be set out on a large platter with the items separated by a garnish of watercress or parsley.

Suggestions for mixed hors d'oeuvres are:

Stuffed olives

Pickled gherkins

Spring onions

Pickles

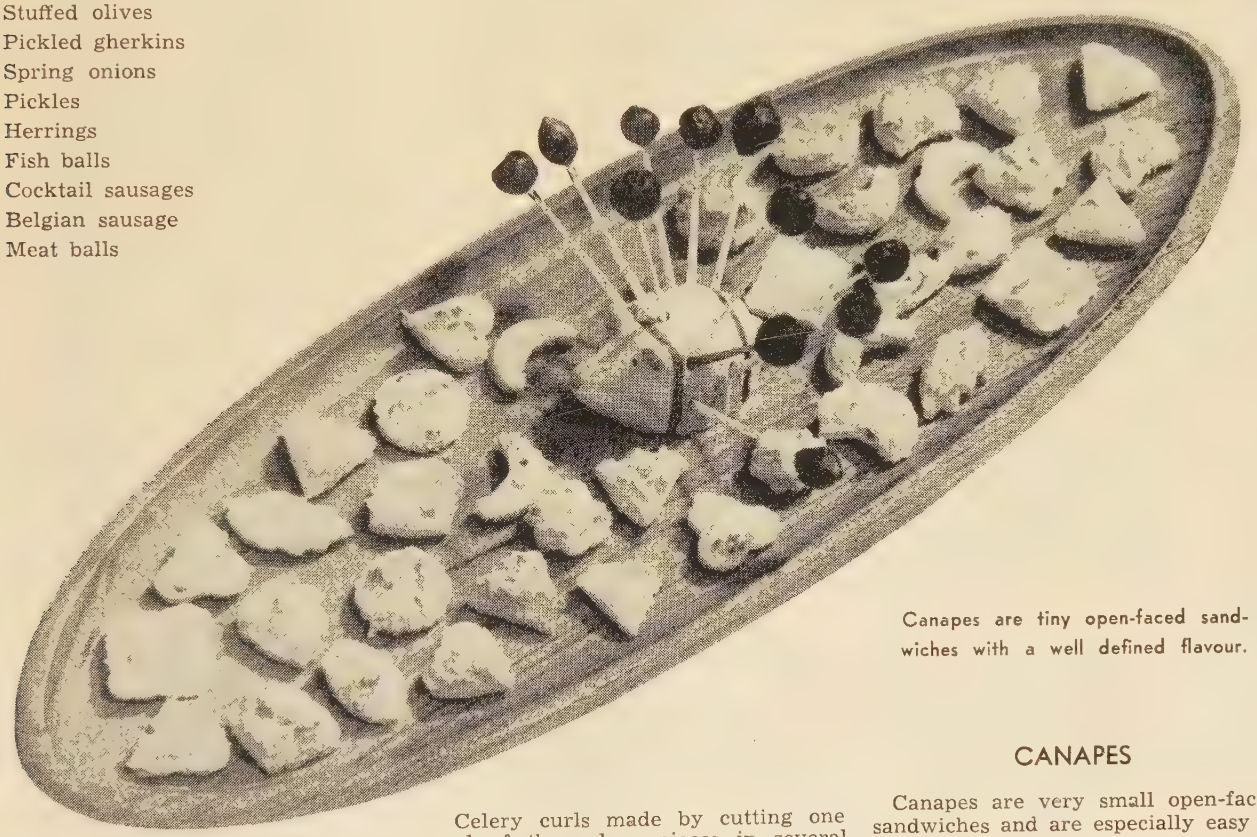
Herrings

Fish balls

Cocktail sausages

Belgian sausage

Meat balls



Canapes are tiny open-faced sandwiches with a well defined flavour.

Slices of ham or tongue

Asparagus and cheese sauce

Stuffed eggs

Sardines garnished with thin flakes of butter and arranged on finger lengths of buttered toast

Filleted anchovies garnished with tiny heaps of finely chopped yolk of hard-boiled egg

Crayfish and mayonnaise arranged on lettuce leaves

Macedoine of vegetables made from a mixture of cold cooked vegetables cut into small cubes and tossed in mayonnaise (peas, carrots, beans, artichokes, and potatoes should be used)

Beetroot, cucumber, and tomatoes cut thinly and arranged in rows with each slice slightly overlapping, garnish with chopped parsley or egg, and served with vinegar

Celery stalks, 2 in. long, with the grooves filled with cream cheese and sprinkled with paprika or parsley

Celery curls made by cutting one end of the celery pieces in several places and then putting them in ice water until the cut ends curl out

Radish roses made by cutting one end of each radish in petal shapes and then placing them in ice water to spread out

Salted Almonds

4 oz of sweet almonds
Salt
½ oz of butter

Blanch the almonds. Dry each one well as it is blanched. Fry them in butter over a gentle heat until they are pale brown. Drain well on crumpled paper. Toss them in some salt, then shake them on a sieve to remove any superfluous salt.

Garlic-flavoured Potato Chips or Peanuts

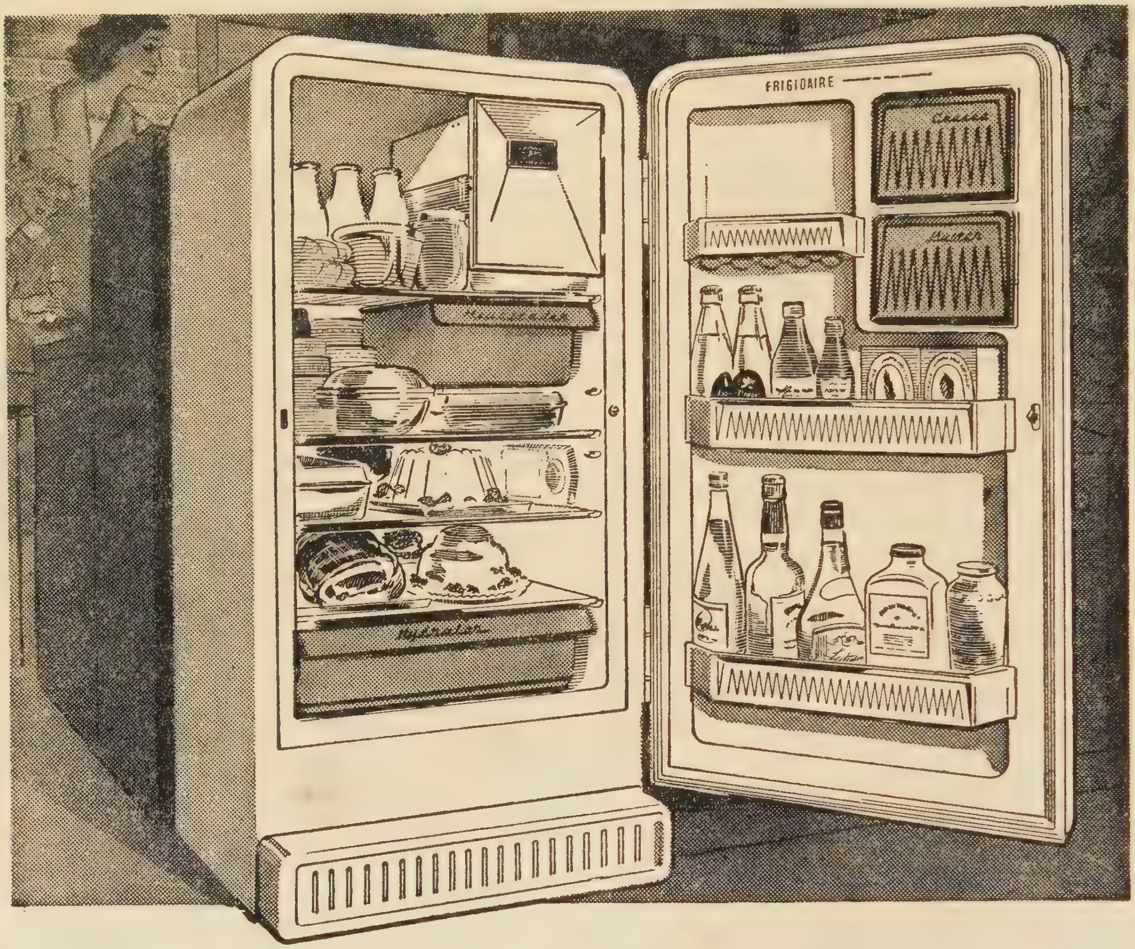
1 quart of potato chips or ½ lb of peanuts
2 cloves of garlic

Halve the two cloves of garlic. Insert a toothpick into each garlic half. Place the potato chips or peanuts with the garlic in a tightly covered container. Let them stand for several hours, occasionally shaking and turning the container. Remove the garlic before serving.

CANAPES

Canapes are very small open-faced sandwiches and are especially easy to eat when standing up at a buffet meal. The bases of the canapes can be made of bread ¼ in. thick and toasted on one side, fried bread, water crackers, shortcrust, or cheese pastry. They are cut into fancy shapes with special hors d'oeuvres cutters, spread with a well defined savoury butter or highly seasoned paste, and garnished.

These will all go a long way in the making of canapes: A hard-boiled egg, 1 oz of cream cheese, some radishes, a tomato, strips of green pepper, a jar of fish or meat paste, some olives, and a tin of sardines.



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Cheese Pastry Base

4 oz of flour
¼ teaspoon of salt
Pepper
2 oz of butter
3 oz of grated cheese
1 egg yolk
Or
Water

Sift the flour, salt, and pepper into a bowl. Cut in the butter until it is well blended, then add the cheese. Mix to a dry dough with one egg yolk or with water.

Chill and roll out ⅛ in. thick. Cut into small fancy shapes. Bake at 425 degrees F.

When cool spread with savoury butter, top with egg and vegetable, and garnish with a contrasting colour.

Green Pea Canapes

Sieve one cup of peas and pipe the mixture on to buttered canapes. Garnish with chopped mint.

Tongue Canapes

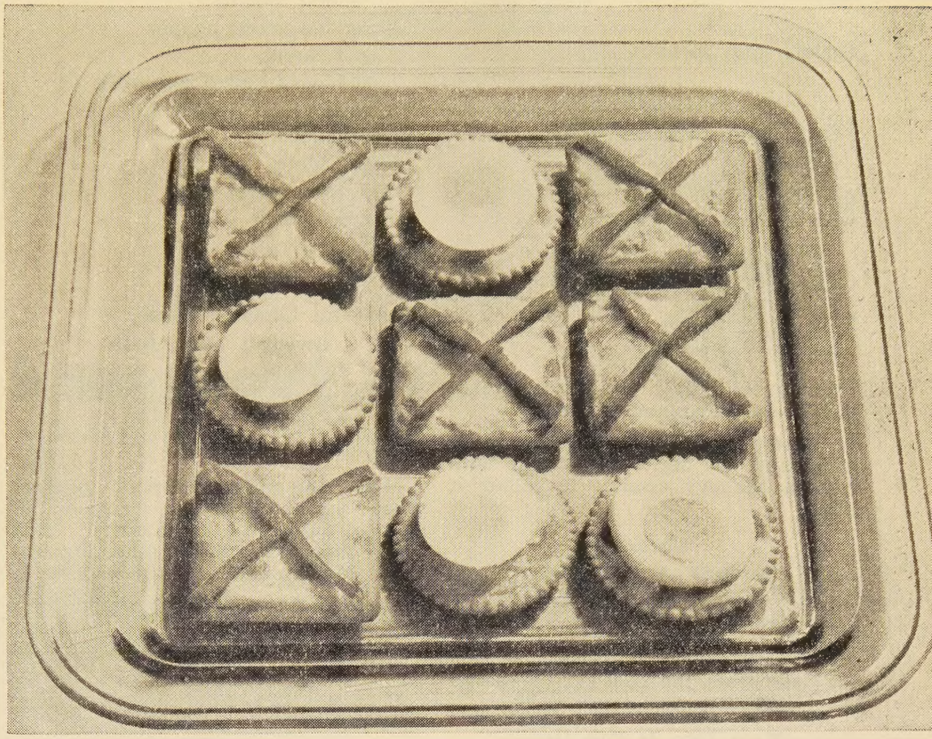
Chop 4 oz of tongue and mash it in a basin with one teaspoon of finely chopped capers. Season well with two teaspoons of mixed mustard, salt, and pepper. A little mayonnaise or tomato ketchup may be added. Spread on the untoasted side of the base.

Peanut Butter and Bacon Canapes

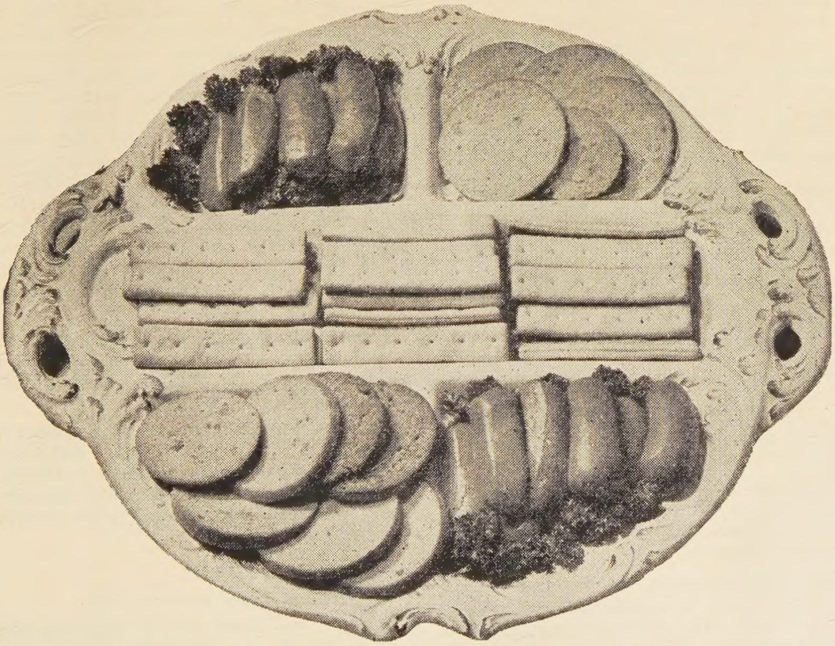
Cover square or oblong canape bases with peanut butter. Top with a piece of cooked crisp bacon to nearly cover the canape.

Crumble crisp bacon into bits and mix them with peanut butter.

Spread the mixture on the base.



Water crackers, spread with a savoury butter and decorated with egg slices and green pepper strips, are arranged to form a game of noughts and crosses.



A variety of meats to choose from is on every smorgasbord tray. This illustration shows garlic sausage, liver sausage, and cocktail sausages.

SMORGASBORD

Scandinavia's most famous contribution to the culinary art is the smorgasbord. This glorified hors d'oeuvre is said to have originated from the country parties of long ago. Each guest brought some kind of food. All the dishes were arranged on a long table round which people walked, choosing from the variety of fish, meat, vegetable and egg salads, and cheeses offered.

Smorgasbord may be simple or elaborate. A simple smorgasbord would consist of foods served on a tray divided into compartments from which items could be chosen by the guests to make their own open-faced sandwiches. The bases can be made from a variety of different kinds of bread cut in various shapes. These are spread with a coloured paste or butter, topped with small pieces of cooked fish or a slice of meat, then a piece of cheese, a slice of hard-boiled egg or tomato, and lastly, to provide greater colour contrast and more flavour, a decorative garnish is added.

HORS D'OEUVRES . . .

Suggestions for a smorgasbord tray are:

Butters and Spreads

Chive

4 oz of butter
¼ cup of chopped chives
1 teaspoon of Worcestershire sauce

Cream the butter thoroughly. Chop the chives very finely and mix them with the butter and sauce.

Anchovy

4 tablespoons of anchovy paste
Or
½ cup of minced anchovies
8 oz of butter
3 teaspoons of lemon juice

Cream the butter, add the anchovies and lemon juice, and stir well.

Anchovy butter may also be made by beating the butter to a cream with enough anchovy essence to colour it pink.

Cheese

½ lb of tasty cheese
½ teaspoon of grated onion
1 tablespoon of vinegar
¼ teaspoon of tabasco
½ teaspoon of Worcestershire sauce

Finely grate the cheese, stir in the other ingredients, and mix well.

Mock Pate de Foie Gras

8 oz of lamb's fry
Yolks of two hard-boiled eggs
Salt and pepper
½ teaspoon of mixed mustard
1½ tablespoons of mayonnaise

Fry the lamb's fry and mince it very finely. Mix it with the other ingredients to form a paste. Rub through a sieve.

Chicken

1 cup of minced chicken
¼ cup of cream
3 tablespoons of sweet pickle

Combine the chicken, cream, and pickle and mix well.

Salmon

1 tin of salmon
1 tablespoon of horse radish
2 teaspoons of lemon juice
2 teaspoons of bottled capers
3 tablespoons of mayonnaise

Combine all the ingredients and mix well.

Fish

Fish balls
Herrings in wine sauce

Meat

Slices of garlic sausage
Slices of liver sausage
Slices of roast beef
Slices of roast pork
Slices of ham
Meat balls
Cocktail sausages

Garnishes

Chopped parsley
Chopped chives
Shredded tomato
Shredded green pepper
Sliced carrot
Sifted hard-boiled egg yolk
Minced green pepper
Radish rose
Sliced olive
Sliced cucumber
Sliced gherkin
Pickles
Cress

Meat and Cheese Dishes

Swedish Meat Balls

½ lb of minced meat
Quarter of an onion
2 tablespoons of fine, soft breadcrumbs
¼ teaspoon of ginger or nutmeg
⅓ cup of water
½ lb of fresh pork
Butter
1 teaspoon of salt
⅛ teaspoon of pepper

Mince the meat and pork together three times. Fry one teaspoon of scraped onion in ½ oz of butter. Add to the meat. Stir in the other ingredients. Mix and blend until smooth.

Shape into very small round balls and fry in butter. Shake the pan occasionally so that they will brown evenly. Serve hot or cold.

If they are to be served hot, pour over any butter which is left.

Cheese Fondue

½ pint of hot milk
1 cup of breadcrumbs
1 beaten egg yolk
1 egg white
¾ cup of grated cheese
1 teaspoon of Worcestershire sauce
¼ teaspoon of salt
⅛ teaspoon of cayenne pepper
½ cup of toasted, sliced Brazil nuts

Pour the milk on to the breadcrumbs. Let them stand for 15 minutes. Add the beaten egg yolk and all the other ingredients except the egg white. Whip the egg white until it is stiff and then fold it in to the other ingredients.

Turn into a buttered casserole, place in a baking pan and half surround with boiling water. Bake until firm (about 1 hour at 350 degrees F).

Garnish with extra toasted, sliced nuts.

Traditional Swedish Casserole

1 lb of chuck steak
6 medium-sized white potatoes
3 sliced onions
1 oz of butter
1 tablespoon of salt
⅛ teaspoon of white pepper
1 cup of water
1 cup of beer
Chopped parsley

Cut the meat into slices ½ in. thick. Peel the potatoes and cut into thick slices. Saute the onions in butter and brown the meat.

Put the potatoes, meat, and onions in layers in a casserole, sprinkling each layer with salt and pepper. The top layer should be potatoes. Barely cover with the liquid and simmer 1 to 1½ hours or until the meat is tender. Sprinkle with chopped parsley.

Variety and Substance

The smorgasbord provides a great range and substance in the foods that are piled on to the one piece of bread. This method of serving food is particularly useful when large numbers of guests are being entertained.

For a more elaborate smorgasbord, the food is arranged on the table, which is pushed against the wall if space is limited. If there is plenty of space, the table may be in the centre of the room and the guests can circulate freely and choose their own food. The food is grouped according to type not only for convenience but so that the cold dishes are not warmed by the hot ones.

All photographs by Sparrow.

How to Wash Leather Gloves

LEATHER gloves can usually be washed satisfactorily if given proper treatment. A tab to say whether they are washable is usually affixed.

Gloves should be washed before they become really soiled. They should be put on the hands and washed, as if washing the hands, in lukewarm suds made from pure mild soap or soapflakes. Very soiled parts can be rubbed with a soft cloth dipped in the suds.

The gloves should be rinsed in lukewarm water, squeezed to press out as much water as possible, taken carefully off the hands, and puffed into to keep the inside surfaces from sticking together. The gloves should then be rolled in a towel and squeezed again to remove more water, puffed into again, and dried flat on a towel away from any direct heat. As they dry they should be worked to soften the leather and keep it pliable. If this is not done and the gloves have dried hard, they can be rolled in a damp towel to soften them; then one glove at a time can be put on the hand, smoothed, and stroked until the leather becomes soft again.

Suede gloves can be brushed with a soft brush to raise the nap, and glace ones can be polished with a soft cloth to restore the finish.

Some chamois leather and doeskin gloves may require slightly different treatment from that already outlined. Washing instructions usually accompany washable gloves and these should be followed exactly.

—*MAUD B. STRAIN,*
Home Science Instructor,
Department of Agriculture,
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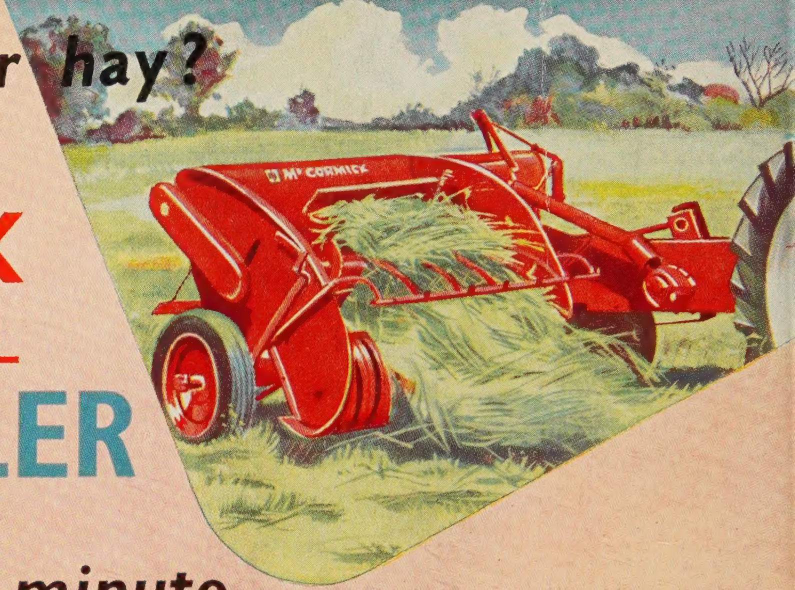

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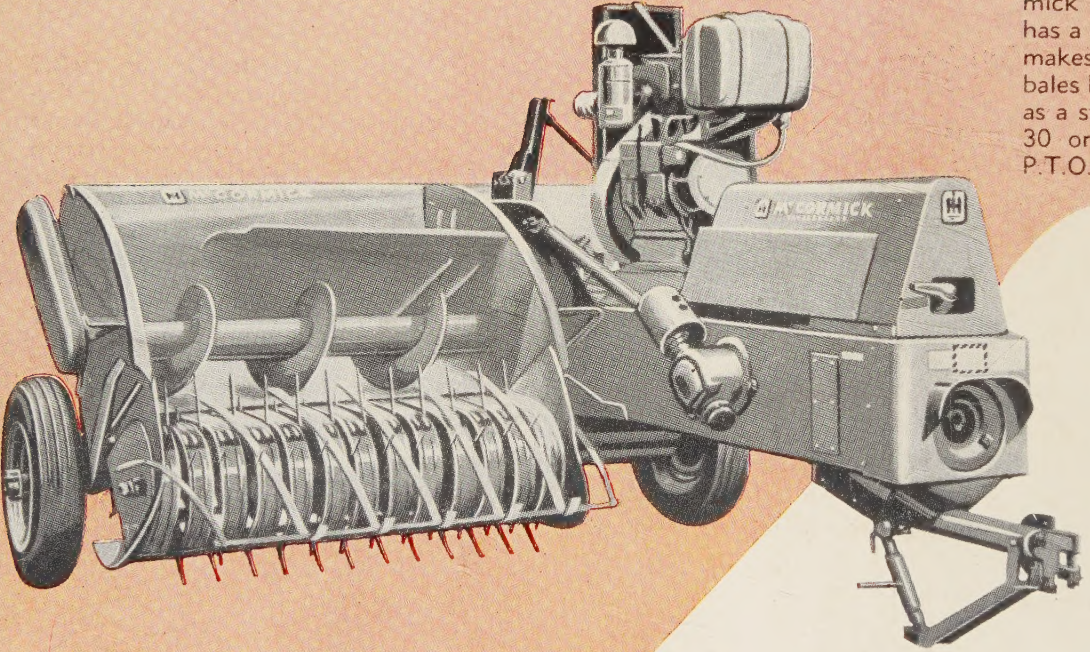

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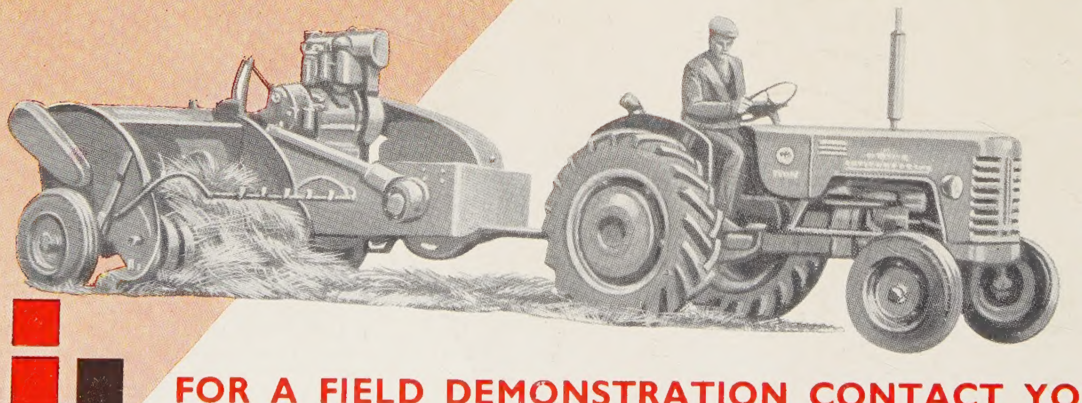

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